2014

The Effectiveness of the Concordance-Discordance Model: Identifying Learning Disabilities in School-Aged Children

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THE EFFECTIVENESS OF THE CONCORDANCE-DISCORDANCE MODEL: IDENTIFYING LEARNING DISABILITIES IN SCHOOL-AGED CHILDREN

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Submitted in Partial Fulfillment of the Requirements for the Degree of

Doctor of Psychology

February 2014

PHILADELPHIA COLLEGE OF OSTEOPATHIC MEDICINE
DEPARTMENT OF PSYCHOLOGY

Dissertation Approval

This is to certify that the thesis presented to us by Bryan Hendricks on the 4th day of February, 2014, in partial fulfillment of the requirements for the degree of Doctor of Psychology, has been examined and is acceptable in both scholarship and literary quality.

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Acknowledgements

I would like to start by acknowledging some people that have supported me throughout the Psy. D. program and dissertation process. I would like to thank my family, especially my parents, Bruce and Debbie Hendricks, for their support and encouragement in all of my endeavors. From the time I can remember you have taught me that I am able to accomplish any goal. You have been amazing parents and I hope that I have made you proud. To my brother and sister, Brett and Lisa, thanks for keeping me grounded throughout the process. To my in-laws, John and Denise Oponik and Mike and Heidi Decimo, I would like to thank you for all the support over the years. Denise, you pushed me for years to get a doctorate and I am grateful for your subtle prompting.

To my friends who provided words of encouragement during the process, I thank you. To Dr. Steve Moraca: you encouraged me throughout the program. You were able to help reframe things during times of stress. Your mentorship is very appreciated. To Dr. Erica Backenson: I want to thank for your support as well. You were always willing to answer questions about the program and provided me with guidance. To Mike Leake: You provided me with the much needed outlet and break from work.

Most importantly, I would like to thank my wife, Alexis, and daughter, London. Alexis, you have encouraged me from day one to pursue my goals. I would have never made it through this process without you. Your faith in my abilities often exceeded the confidence I had in myself. Your constant support and words kept me motivated. During the times I was down, you were there to pick me up. You were always willing to take care of the baby and provide me the time necessary to complete my coursework and work on my dissertation. To London: You were one of the driving forces to complete the dissertation. I look forward to the one day when you say, “My daddy’s a doctor!” Hopefully the completion of the program will help provide you opportunities and experiences in life. I hope one day that I can instill in you the values that I learned from my parents; namely, that you are able to accomplish your goals and succeed at any endeavor you pursue.

I would like to recognize the guidance and supports provided to me by my committee members and recognize their contributions to this research project. To Dr. Lisa Hain: After considering a number of topics for my dissertation, you introduced me to the Concordance-Discordance Model. It was through your passion of neuropsychological assessment and knowledge of C-DM that helped me develop my topic. I am very grateful for you helping me refine my topic and your suggestions were always much appreciated. I am thankful that you were always willing to take the time to respond to my questions. You provided me with much needed support and encouragement throughout the process. To Dr. George McCloskey: I was at a crossroads when I started my pursuit of a doctorate. I had been out of school for years and after my first class I was not sure if was going to continue. Fortunately my second class was the Cognitive Affective Basis of Behavior course that you taught. Your knowledge and expertise were what I expected from a doctoral program. Your encouragement early on helped shape my drive and determination during the dissertation process. To Dr. Williams, you have provided me with support and supervision from my earliest days as a school psychology student and school psychologist. You wisdom and encouragement helped shaped me into the professional that I am today and I am truly thankful.

I would like to thank my Psy.D. cohort for all their support. Quite often cohorts build a reputation based upon some unique characteristic and thankfully I was a member of the “caring” cohort. I will always fondly remember how we looked out for one another and whenever we came across a challenge someone was always there to provide support.

Abstract

After the reauthorization of Individuals with Disabilities Education Act (IDEA) in 2004, the federal regulations indicated that there are three possible methods for the identification of a Specific Learning Disability (SLD). The three methods include the ability-achievement discrepancy (AAD), Response to Intervention (RTI), and the addition of a third method, which consists of other alternative research-based procedures. Hale and Fiorello (2004) proposed the use of a Concordance-Discordance Model (C-DM), which suggests that learning disabled students have discordance between processing strength and both processing weakness and achievement deficit. In addition, SLD students have a concordance between the achievement deficit and processing weakness. It is suggested that CD-M represents a more accurate method in identifying children with learning disabilities than the AAD model. The current study was designed to determine if students previously classified through AAD would also be found eligible for special education through CD-M. Cognitive and academic profiles for CD-M and AAD identified students were examined, as well as academic placement and SLD subtypes. In this sample of data drawn from a population of students identified with SLD (n = 173), chi square, independent samples t-tests, bivariate correlations, and analyses of variance were performed. Results indicated that approximately half of the students previously classified through AAD were eligible for special education through CD-M. No differences between noted between the two groups with academic placement. Significant differences were found between Full Scale IQ, index scores, and identified WISC-IV subtests and academic achievement domains between the two groups. Significant, positive relationships were noted on WISC-IV and achievement measure

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Chapter 1

Introduction

After the reauthorization of Individuals with Disabilities Education Act (IDEA) in 2004, the federal regulations indicated that there are three possible methods for the identification of a Specific Learning Disability (SLD). The three methods include the ability-achievement discrepancy, Response to Intervention (RTI), and the addition of a third method, which consists of other alternative research-based procedures. Schools have the option to choose from among these methods, or to utilize a combination of approaches. State education agencies (SEA) make the determination about what approach to take at the state level; therefore, states may choose different approaches. This leads to the nebulous nature of determining SLD. According to the National Association of School Psychologists' (NASP) position statement (2011), the identification of and service delivery to children identified as having a specific learning disability should be based on the outcomes of multitiered, high quality, and research-based instruction. School psychologists have long had a prominent role as members of school teams that identify students exhibiting SLD. Therefore, NASP is dedicated to promoting policies and practices that are consistent with scientific research. School psychologists are scientist-practitioners, who are both consumers of and contributors to research. NASP recommends that an initial evaluation of a student with a suspected specific learning disability include individual comprehensive assessment, as prescribed by the evaluation team. Expertise in SLD is an essential area of specialization for all school psychologists. Therefore, school psychologists should be knowledgeable about the emerging research on specific learning disabilities, including the nature and identification of learning disabilities. In an attempt to decide about a student's eligibility for special education services, multidisciplinary teams utilize information provided by school psychologists, learning specialists, and/or independent evaluators (McBride, Dumont, & Willis, 2004). When reviewing the literature on the ability achievement discrepancy model and RTI, one may question the need for a third method for identifying students with SLD.

Statement of the Problem

The concept of learning disabilities gained official status in 1975 with the passing of the Education for All Handicapped Children Act (EHA). It became necessary to develop an objective means for identifying and diagnosing LD (Aaron, Joshi, Gooden, & Bentrum, 2008). Because learning disabilities are defined in terms of average to above-average intelligence but below-average performance, it was proposed that students suspected of having learning disabilities would have a significant gap between their IQ scores and achievement. This way of identifying LD came to be referred to as the ability-achievement discrepancy (AAD) model. However, the uniform discrepancy application has been criticized for being insensitive to differences in cognition and achievement. Often times, it is unclear about which IQ score should be used to establish a student's ability. The discrepancy model has been criticized for an inability to distinguish between learning disabilities and low achievers. With an inconsistent application about the approach across schools, districts, and states students may be deemed learning disabled in one district and not in another. Over-identification of students from diverse backgrounds as well as measurement problems resulting in poor decision-making have also been highly problematic. The discrepancy model has been disparaged as a "wait-to-fail" model (Learning Disabilities Association of America, 2010).

From the years 1976 through 2005, the number of students receiving federally supported special education programs increased from 8.3 percent to 13.8 percent (National Center for Education Statistics, 2012). This overall increase can be attributed to a rise in the number of students classified as having a specific learning disability. Although the percentage of students identified as learning disabled has decreased since 2005, approximately 5 percent of students in 2009-2010 (National Center for Education Statistics, 2012) are classified with a specific learning disability. Students diagnosed with specific learning disabilities represent over one-half of classified students in the United States (Zirkel & Thomas, 2010).

When IDEA was rewritten and signed into law in 2004, changes were made in the statute to reflect new ideas around learning disabilities and the idea of a pre-intervention strategy called response to intervention (RTI). The emphasis of RTI is to encourage earlier intervention for students experiencing difficulty by providing more effective instruction. By providing more effective instruction at specific targeted areas, students will be less likely identified as learning disabled. Although RTI is important for the prevention of learning problems and for providing early intervention services for all children is critical, RTI is problematic for SLD identification purposes for a variety of reasons (Hale, Naglieri, Kaufman, & Kavale, 2004). There has been no consensus on the type of RTI to use or on a measurement model for defining responsiveness in RTI models. A major concern with RTI has to do with the determination of the scientific teaching method for reading and other core academic areas. Because there are numerous cognitive constructs necessary for academic achievement, it is difficult for teachers to ensure that the curriculum addresses each construct. Even if teachers are trained to competency, the approach does not specify who will design, develop, or evaluate whether or not children are responding to the interventions (Hale et al., 2004). In addition, RTI has no mechanism for differential diagnosis of SLD and other disorders. It has been suggested that RTI has no true positive, which means that all children who fail to respond to intervention are considered SLD by default (Learning Disability Association of America, 2010).

After the reauthorization of IDEA in 2004, the federal regulations indicated that there are three possible methods of identifying SLD. Schools have the option to choose from among the methods, or to utilize a combination of approaches. The three methods include the ability-achievement discrepancy model (AAD), Response to Intervention (RTI), and the addition of a third method, which consists of other alternative research-based procedures. Naglieri (1999) first developed the Discrepancy/Consistency Model for use with the Cognitive Assessment System, which measures basic psychological processes of Planning, Attention, Simultaneous, and Successive. This ipsative methodology determines the time when within-child variability is greater than expected, given the unreliability of the scores (Hale et al., 2008). Individual scores significantly below the child's average are considered a weakness, and those significantly above are considered to be a strength. Flanagan, Ortiz, Alfonso, and Mascolo (2006) developed an operational definition of SLD. The Dual Discrepancy/Consistency (DD/C) operational definition of SLD is grounded in the Cattell-Horn-Carroll (CHC) theory, learning disabilities literature, and the relationships between cognitive abilities, processes, and academic skills. This SLD identification approach incorporates specific criteria within three data collection levels that correspond to different RTI tiers (Hale, Flanagan, &

Naglieri, 2008). Hale and Fiorello (2004) proposed the use of a Concordance-Discordance Model (C-DM), which has three criteria necessary in order to identify a learning disability. Through the model, practitioners look for a concordance between the deficit achievement area and the neuropsychological processes associated with that area, and attempt to rule out other possible causes for the disorder. Discordance between the deficit achievement area and neuropsychological processes not related to the achievement area in question are examined. Third, discordance between processing strengths and weaknesses are investigated.

Although the outcomes for students classified with learning disabilities have shown improvement over the years, research suggests that half of secondary students with SLD perform more than three grade levels below their enrolled grade in math and reading. Students with SLD are less likely to graduate from high school with a regular diploma, are more likely to drop out of high school, are less likely to be enrolled in a four-year college within two years of leaving school, have higher unemployment rates, and are not in the labor force due, in part, to the lack of education (National Center for Learning Disabilities, 2013).

It is suggested that the third method to SLD identification, particularly the Concordance-Discordance Model, represents a more accurate method in identifying children with learning disabilities than the ability-achievement discrepancy model. In addition, C-DM can lead to more effective interventions because it helps the team recognize each individual’s unique cognitive strengths and weaknesses. This evidence-based model leads to identification of cognitive strengths, and cognitive deficits associated with achievement deficits and differs with the ability-achievement discrepancy model and RTI approaches to SLD classification (Hale et al., 2008).

Purpose of the Study

The purpose of the present study is to examine the impact of the Concordance-Discordance Model on identifying eligibility for special education under the classification specific learning disability when compared with students previously identified with a specific learning disability through the ability-achievement discrepancy model. The purpose of the study will help to determine if there is a significant difference in the number of students identified with a specific learning disability using the C-DM approach versus the ability-achievement discrepancy model. The study will also investigate profile differences and academic placements between the students identified via C-DM and AAD.

Research Questions

1. Are students who were previously classified through the ability-achievement discrepancy model less likely to be identified through the Concordance-Discordance Model?
    a. Does the proportion of students identified through the models differ?
    b. What is the strength and magnitude of these proportions?
2. Are there significant differences in the cognitive profiles and academic achievements of students identified through ability-achievement discrepancy model and Concordance-Discordance Model?
    a. Are there differences at the subtest level between students identified through CD-M and AAD on the WISC-IV?

   b. Do academic achievement areas differ by domain (reading, writing, and math)?
   c. Are there cognitive differences within identified specific learning disability areas (Oral expression; Listening comprehension; Written expression; Basic reading skills; Reading fluency skills; Reading comprehension; Mathematics calculation; Mathematics problem solving)?
3. Are students who are receiving intensive supports more likely to be identified through the ability-achievement or Concordance-Discordance Model?
   a. Are there significant differences in identification methods between students in mainstream, in-class resource, or pullout-out replacement resource placements for English Language Arts?
   b. Are there significant differences in identification methods between students in mainstream, in-class resource, or pullout-out replacement resource placements for Math?

Chapter 2

Review of the Literature

Classification Systems for SLD

Classification criteria are the regulations that are implemented to determine if an individual is eligible for a particular diagnosis. Although the evaluation of learning disabilities in school-aged children is guided by the mandate of IDEA 2004, diagnostic criteria for learning disabilities are also included in the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5; American Psychiatric Association, 2013), and the International Classification of Diseases (ICD-10; World Health Organization, 2006).

ICD-10

The ICD-10 (2006) is the 10th revision of the International Classification of Diseases and Related Health Problems, a medical classification list by the World Health Organization (WHO) used by more than 25 countries worldwide. It codes for diseases, signs and symptoms, abnormal findings, complaints, social circumstances, and external causes of injuries. The ICD-10 also includes learning difficulties in their coding system and highlights the following types of learning disorders: Specific Reading Disorder, Specific Spelling Disorder, Specific Disorder of Arithmetical Skills, Mixed Disorder of Scholastic Skills, Other Developmental Disorders of Scholastic Skills, and Developmental Disorder of Scholastic Skills, Unspecified. In order to meet the criteria for a Specific Reading Disorder, (1) it is necessary to have a score on reading accuracy and/or comprehension that is at least 2 standard errors of prediction below the level expected on the basis of the child’s chronological age and general intelligence; both reading skills and IQ are assessed on an individually administered test standardized for the child's culture and educational system, or (2) a history of serious reading difficulties, or test scores that met criteria 1 at an earlier age, plus a score on a spelling test that is at least 2 standard errors of prediction below the level expected on the basis of the child's chronological age and IQ. The disturbance in 1 or 2 must significantly interfere with academic achievement or activities of daily living that require reading skills. It is not directly due to a defect in visual or hearing acuity, or to a neurological disorder, and also, school experiences are within the average acceptable range. The most commonly used exclusion criteria is an IQ score below 70 on an individually administered standardized test.

A Specific Spelling Disorder requires a score on a standardized spelling test that is at least 2 standard errors of prediction below the level expected on the basis of the child's chronological age and general intelligence. In order to meet criteria, scores on reading accuracy and comprehension, and on arithmetic, are within the normal range (± 2 standard deviations from the mean) and no history of significant reading difficulties are noted. The spelling difficulties are present from the early ages of learning to spell and the disturbance significantly interferes with academic achievement or activities of daily living that require spelling skills. The most commonly used exclusion criteria is an IQ below 70 on an individually administered standardized test.

Specific Disorder of Arithmetical Skills requires a score on a standardized arithmetic test that is at least 2 standard errors of prediction below the level expected on the basis of the child's chronological age and general intelligence. Scores on reading accuracy and comprehension, and on spelling are within the normal range (± 2 standard deviations from the mean) and there is no history of significant reading or spelling difficulties. School experiences have to be within the average acceptable range (i.e., there have been no extreme inadequacies in educational experience) and the arithmetic difficulties must be present from early stages of learning arithmetic. The disturbance must significantly interfere with academic achievement of activities of daily living that require mathematical skills. An IQ below 70 on an individually administered test is the most commonly used exclusion criteria.

Mixed Disorder of Scholastic Skills is noted by the ICD-10 as an "ill-defined, inadequately conceptualized (but necessary) residual category of disorders in which both arithmetical and reading or spelling skills are significantly impaired, but in which the disorder is not solely explicable in terms of general mental retardation or inadequate schooling." It should be used for disorders meeting the criteria for Specific Disorder of Arithmetical Skills and either Specific Reading Disorder or Specific Spelling Disorder. According to the ICD-10 (2006), the category of Developmental Disorder of Scholastic Skills, Unspecified should be avoided "as far as possible" and should be used only for unspecified disorders in which there is a significant disability of learning that cannot be solely accounted for by mental retardation, visual acuity problems, or inadequate schooling.

DSM-5

The Diagnostic and Statistical Manual of Mental Disorders (DSM-5: American Psychiatric Association, 2013) serves as a universal authority for the diagnosis of psychiatric disorders. According to the DSM-5 (2013), a specific learning disorder is noted as a neurodevelopmental disorder with a biological origin that is the basis for abnormalities at a cognitive level that are associated with the disorder. The biological origin includes an interaction of genetic, epigenetic, and environmental factors that affect the brain's ability to perceive or process verbal or nonverbal information efficiently or accurately. One of the essential features in the diagnosis of specific learning disorder includes difficulties learning and using academic skills, as indicated by the presence of at least one of six symptoms that have persisted for at least 6 months, despite the provision of interventions that target those difficulties. These symptoms include: (1) Inaccurate or slow and effortful word reading (e.g., read single words aloud incorrectly or slowly and hesitantly, frequently guesses words, has difficulties sounding out words); (2) Difficulty understanding the meaning of what is read (e.g., may read text accurately but not understand the sequence, relationships, inferences, or deeper meanings of what is read); (3) Difficulties with spelling (e.g., may add, omit, or substitute vowels or consonants); (4) Difficulties with written expression (e.g., makes multiple grammatical or punctuation errors within sentences, employs poor paragraph organization, written expression of ideas lack clarity); (5) Difficulties mastering number sense, number facts, or calculation (e.g., has poor understanding of numbers, their magnitude, and relationships, counts on fingers to add single-digit numbers instead of recalling the math fact as peers do, gets lost in the midst of arithmetic computation and may switch procedures); (6) Difficulties with mathematical reasoning (e.g., has severe difficulty applying mathematical concepts, facts, or procedures to solve quantitative problems).

The previous version of the DSM-V, the DSM-IV-TR (2000), had separate diagnostic categories to indicate a Reading Disorder (dyslexia), Writing Disorder (written expression disorder) and Math Disorder (dyscalculia), but in terms of coding on the

DSM-5, the practitioner must specify all academic domains and subskills that are impaired. When an individual has an impairment in reading, the practitioner should identify if it is in word reading accuracy, reading rate/ fluency, or reading comprehension. The DSM-5 indicates that dyslexia is an alternative term used to refer to a pattern of learning difficulties characterized by problems with accurate or fluent word recognition, with poor decoding, and poor spelling abilities. Impairments in written expression are identified by spelling accuracy, grammar and punctuation accuracy, and clarity or organization of written expression. Impairments in mathematics are identified in the areas of number sense, memorization of arithmetic facts, accurate or fluent calculation, and accurate math reasoning. The DSM-5 highlights the fact that dyscalculia is an alternative term used to refer to a pattern of difficulties characterized by problems in processing numerical information, learning arithmetic facts, and performing accurate or fluent calculations.

In addition to difficulties learning and using academic skills, the affected academic skills are substantially and quantifiably below those expected for the individual's chronological age, and cause significant interference with academic or occupational performance, or with activities of daily living. This is confirmed by individually administered, standardized achievement measures and comprehensive clinical assessment. For individuals age 17 years and older, a documented history of impairing learning difficulties may be substituted for the standardized assessment. The DSM-5 acknowledges that the learning difficulties begin during school-age years, but may not become fully manifested until the demands for those affected academic skills exceed the individual's limited capacity (e.g., timed tests, reading or writing lengthy complex reports with a deadline, excessive academic loads). As an exclusionary measure, the learning difficulties are not better accounted for by intellectual disabilities, uncorrected visual or auditory acuity, other mental or neurological disorders, psychosocial adversity, lack of proficiency in the language of academic instruction, or inadequate educational instruction.

The DSM-5 indicates that a comprehensive assessment is required for a diagnosis of a specific learning disorder. It can be diagnosed only after formal education starts, but can be diagnosed at any point afterward in children, adolescents, or adults, providing there is evidence of onset during the years of formal schooling. No single data source is sufficient for a diagnosis of specific learning disorder. Specific learning disorder is a clinical diagnosis based on an amalgamation of the individual's medical, developmental, educational, and family history; the history and impact of the learning difficulty; previous or current school reports; curriculum-based assessments, and previous or current scores from individual standardized tests of academic achievement. If an intellectual, sensory, neurological, or motor disorder is suspected, then the clinical assessment for specific learning disorder should also include methods appropriate for these disorders. Therefore, a comprehensive assessment should involve professionals with expertise in specific learning disorders and psychological/cognitive assessment.

An aspect of the DSM-5 includes the specification of the severity of the specific learning disorder. If an individual is demonstrating difficulties learning skills in one or two academic areas, but the difficulties are mild enough so that the individual may be able to compensate or function when provided appropriate accommodations or support services, the severity is noted as mild. A moderate specific learning disorder is marked by difficulties learning skills in one or more academic domains, so that the individual is unlikely to become proficient without intensive and specialized teaching during the school years. Some accommodations or support services are needed for at least part of the school day, in the workplace, or at home in order to complete activities accurately and efficiently. Severe learning disorder results in major difficulties in learning skills, impacting several academic domains, so that the individual is unlikely to learn those skills without ongoing intensive, individualized and specialized instruction throughout school. Even with these supports, the individual may not be able to complete daily activities efficiently without assistance.

IDEA 2004

The Individuals with Disabilities Education Act (IDEA) was signed into law on December 3, 2004. The provisions of the act became effective on July 1, 2005 and the final regulations were published on August 14, 2006. According to IDEA (2004), a specific learning disability is defined as:

(i) *General*. The term means 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, including conditions such as perceptual disabilities, brain injury, minimal brain dysfunction, dyslexia, and developmental aphasia.

(ii) *Disorders not included*. The term does not include learning problems that are primarily the result of visual, hearing, or motor disabilities, of mental retardation, of emotional disturbance, or of environmental, cultural, or economic disadvantage. (34 CFR 300.8)

Procedures for identifying SLD

According to IDEA regulations for additional procedures for identifying children with specific learning disabilities, a state must adopt criteria for determining whether or not a child has a specific learning disability as defined in 34 CRF 300.8(c)(10). The State must permit the use of a process based on the child's response to scientific, research-based intervention, and may permit the use of other alternative research-based procedures for determining whether or not a child has a specific learning disability.

Required group members. A public agency must use the State criteria in determining whether or not a child has a specific learning disability. The determination of whether or not a child suspected of having a specific learning disability is, in fact, a child with a disability must be made by the child's parents and a team of qualified professionals. This must include the child's regular teacher (or a regular classroom teacher qualified to teach a child of his or her age or an individual qualified by the SEA to teach a child of his or her age) and at least one person qualified to conduct individual diagnostic examinations of children (e.g., school psychologist, speech-language pathologist, remedial reading teacher).

Criteria for determining SLD. The group may determine that a child has a specific learning disability if the child does not achieve adequately for the child's age or does not achieve sufficiently well to meet State-approved grade-level standards in one or more of the following areas, when provided with learning experiences and instruction appropriate for the child's age or State-approved grade level standards: Oral expression;

Listening comprehension; Written expression; Basic reading skills; Reading fluency skills; Reading comprehension; Mathematics calculation; Mathematics problem solving. In addition, the child does not make sufficient progress to meet age or state-approved grade-level standards in one or more of the areas identified in 34 CR 300.309(a)(1) when using a process based on the child's response to scientific, research-based intervention; or the child exhibits a pattern of strengths and weaknesses in performance, achievement, or both, relative to age, State-approved grade-level standards, or intellectual development, determined by the group to be relevant to the identification of a specific learning disability, using appropriate assessments, consistent with 34 CRF 300.304 and 300.305; and the group determines that its findings are not primarily the result of a visual, hearing, or motor disability, mental retardation, emotional disturbance, cultural factors, environmental or economic disadvantage or limited English proficiency.

To ensure that underachievement in a child suspected of having a specific learning disability is not due to lack of appropriate instruction in reading or math, the group must consider data demonstrating that prior to, or as a part of, the referral process, the child was provided appropriate instruction in regular education settings, delivered by qualified personnel. The group must also consider data-based documentation of repeated assessments of achievement at reasonable intervals, reflecting formal assessment of student progress during instruction, which was provided to the child's parents.

Description of the required observation. The public agency must insure that the child is observed in the child's learning environment (including the regular classroom setting) to document the child's academic performance and behavior in the areas of difficulty. The group, in determining whether or not a child has a specific learning disability, must decide to use information from an observation in routine classroom instruction and monitoring of the child's performance that was done before the child was referred for an evaluation. The group may also have at least one member of the group conduct an observation of the child's academic performance in the regular classroom after the child has been referred for an evaluation and parental consent is obtained.

Documentation required for eligibility. For a child suspected of having a specific learning disability, the documentation of eligibility must contain a statement of whether the child has a specific learning disability and the basis for making the determination, including an assurance that the determination has been made in accordance with 34 CFR 300.306(c)(1). The documentation must describe the relevant behavior, if any, noted during the observation of the child and the relationship of that behavior to the child's academic functioning. Educationally relevant medical findings must be considered. The documentation of eligibility must contain a statement that determines whether or not the child does not achieve adequately for the child's age or does not meet State-approved grade-level standards and the child does not make sufficient progress to meet age or State-approved grade-level standards. The group must consider if the child exhibits a pattern of strengths and weaknesses in performance, achievement, or both, relative to age, to state-approved grade-level standards or intellectual development. Determination by the group concerning the effects of a visual, hearing, or motor disability, mental retardation, emotional disturbance, cultural factors, environmental or economic disadvantage, or limited English proficiency on the child's achievement level must be documented. Finally, the documentation of eligibility must contain a statement regarding whether or not the child has participated in a process that assesses the child's response to scientific, research based interventions and the instructional strategies used and the student-centered data collected. Last, the statement must contain documentation that the child's parents were notified about: (1) the State's policies regarding the amount and nature of student performance data that would be collected and the general education services that would be provided; (2) strategies for increasing the child's rate of learning; and (3) the parents' right to request an evaluation.

It is important to note that all three systems use somewhat vague and ambiguous terms, which significantly interferes with the efforts of practitioners to identify learning disabilities reliably and validly (Kavale & Forness, 2006). Despite the existence of various classification systems (e.g., ICD-10, DSM-IV TR, DSM-V), students ages 3 to 21 years who experience learning difficulties in school are most typically evaluated according to IDEA 2004 specifications to determine if they qualify for special education services (Sotelo-Dynega, Flanagan, & Alfonso, 2011). The DSM-5 is more closely aligned with IDEA 2004, particularly in no longer requiring an IQ-discrepancy for the diagnosis of a specific learning disorder. In addition, the DSM-5 allows Response to Intervention (RTI) as one diagnostic criteria. The DSM-5 also places a greater emphasis on the importance of comprehensive assessment, use of a broad array of data sources, cultural issues, and the role of clinical judgment in the diagnostic processes, when compared with the DSM-IV-TR (Klotz, 2013). However, regardless of DSM-5 diagnosis, a disability must impact one or more of the basic skill areas (e.g., Oral Expression, Listening Comprehension, Written Expression, Basic Reading Skills, Reading Comprehension, Mathematics Calculation, Mathematics Reasoning, Reading Fluency) in order for special education eligibility to be identified. Because the classification category of SLD as described in the IDEA statute includes imprecise terms, the United States Department of Education published the Federal Regulations (34 CFR, Part 300) with the intent of clarifying the statute and providing guidance to State Education Agencies as they worked to develop their own regulations (Sotelo-Dynega, Flanagan, & Alfonso, 2011).

The Ability-Achievement Discrepancy Model and SLD Identification

In 1975, the signing into law of P.L. 94-142 mandated that public schools provide a Free and Appropriate Public Education (FAPE) to all students, including those with learning disabilities. As a result, it became necessary to develop an objective way for identifying and diagnosing learning disabilities (Aaron, Joshi, Gooden, & Bentum, 2008). Because learning disabilities were previously defined in terms of students demonstrating average to above-average intelligence but below-average performance, it was suggested that students suspected of having learning disabilities would have a significant gap between their IQ score and academic achievement. This method for identifying learning disabilities came to be known as the discrepancy model. The specific learning disability (SLD) category has been controversial since its inception due to a failure to achieve consensus about fundamental issues, such as SLD definition and the way in which it should be operationalized. Although early efforts to implement a classification of SLD based on the “unexpected achievement” construct were too broad and included children with primary behavior problems, the construct has always attempted to address students who struggle to master reading, writing, and mathematics, despite the absence of conditions known to interfere with mastery of academic skills. Students continue to be identified with learning disabilities and the numbers of students classified as SLD have reached unequaled and staggering proportions in special education. With the increasing SLD numbers, it has been argued that it is difficult to determine the validity of a SLD diagnosis. As a result, overidentification became widespread. With the reliability of the SLD construct continuously undermined, underachievement has come to be seen as being equivalent to learning disabilities, rather than one possible component of a conceptual understanding of learning disabilities (Scruggs & Mastropieri, 2002).

Over-Identification of Students

Inconsistent Applications Across States. According to the reauthorized IDEA (2004), "a state must adopt, consistent with 34 CFR 300.309, criteria for determining whether a child has a specific learning disability as defined in 34 CFR 300.8(c)(10)." In addition, the criteria adopted by the state must not require the use of a severe discrepancy between intellectual ability and achievement for determining whether a child has a specific learning disability, as defined in 34 CFR 300.8(c)(10); must permit the use of a process based on the child's response to scientific, research-based intervention, and may permit the use of other alternative research-based procedures for determining whether or not a child has a specific learning disability, as defined in 34 CFR 300.8(c)(10). It is important to emphasize the concept that a state must "adopt criteria for determining whether a child has a specific learning disability." With that in mind, the state education agency (SEA) interprets the statutes and regulations set forth from the federal government. The state educational agency refers to the state board of education or other agency or officer primarily responsible for the state supervision of public elementary schools and secondary schools. The term local educational agency (LEA) means a public board of education or other public authority legally constituted within a state for either administrative control or direction of, or the performance of a service function for, public elementary schools or secondary schools in a city, county, township, school district, or other political subdivision of a state, or for such combination of school districts or counties as are recognized in a state as an administrative agency for its public elementary schools or secondary schools (IDEA, 2004). Although the individual state statutes and regulations may provide more rights than federal laws, they cannot provide fewer or weaker rights than guaranteed by federal law. Some states have added more definitions to their special education regulations than are required and may provide parents with more rights than the federal act; they may not restrict those rights. Similarly, they can increase the burden on their LEAs; they cannot decrease them (McBride, Dumont, & Willis, 2011).

Although the federal regulations regarding the SLD definition and classification criteria influence state definitions and criteria, states exercise significant discretion in the special education nomenclature, definitions, and classification criteria (Reschly & Hosp, 2004). Specific learning disability is diagnosed by multidisciplinary teams in local education agencies, or by private practitioners, who generally apply conceptual definitions and classification criteria adopted by state education agencies. Classification criteria specify the requirements that must be met to establish that an individual qualifies for a particular diagnosis, such as SLD. Federal regulations provide general guidance to SEAs and LEAs about determining the eligibility of individuals for SLD. However, these are general guidelines adopted by SEAs and are not consistent among states. SEAs can abolish or permit the use of discrepancy in their states, or LEAs may use (but are not require to use) a discrepancy methodology if the SEA permits. The federal regulations do not provide any specific definition or guidance to aid states or schools in determining the extent of the discrepancy that is needed for eligibility under the SLD designation (McBride et al., 2011). Federal regulations for IDEA and EHA have never specified numerical cut-offs for ability-achievement discrepancies for SLD.

One of the criticisms levied at the ability-achievement discrepancy model is that it is applied inconsistently across local and state educational agencies, leading to variable classification rates and data that undermine the SLD construct (MacMillan, Gresham, & Bocian, 1998). Reschly and Hosp (2004) examined the variations from state to state in terms of their application of the SLD definition and processes for determining eligibility. The term specific learning disability is utilized in 42 states. Seven states use the term learning disabilities (LD), and one state (Colorado) uses the term perceptual and communicative disability. All states provide a definition of SLD and recent trends have been toward a more widespread adoption of the SLD definition that appears in federal regulations at 34 C.F.R. 7 (Reschly & Hosp, 2004). More than two-thirds of the states use the federal definition and seven additional states use the federal definition with minor variations. Fundamental to understanding any approach to identification of SLD is an understanding of classification. A majority of states define SLD as,

> (iii)*General*. The term means 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, including conditions such as perceptual disabilities, brain injury, minimal brain dysfunction, dyslexia, and developmental aphasia.

(iv) *Disorders not included*. The term does not include learning problems that are primarily the result of visual, hearing, or motor disabilities, of mental retardation, of emotional disturbance, or of environmental, cultural, or economic disadvantage. (34 CFR 300.8)

Analysis of the SLD definition in those states with alternative definition revealed that nearly all of these definitions are similar to the federal definition because eight of the nine states include a psychological processing component and most include language processing. Reschly and Hosp (2004) reported that other states have developed definitions that combine features of the federal and National Joint Committee on Learning Disabilities (NJCLD) definitions. Some of these states have added the phrase such as “significant discrepancy between intellectual ability and achievement” to the federal definition.

Unlike the other disability categories listed in the federal code, the original Education for All Handicapped Children Act (EHA) included special classification criteria for SLD, which has remained relatively consistent since 1977. The critical aspects of these regulations are as follows: (a) severe discrepancy between achievement and intellectual ability in one or more of the following areas: oral expression, listening comprehension, written expression, basic reading skill, reading comprehension, mathematics calculation, mathematics reasoning, and (b) exclusionary factors, which suggest that SLD cannot be due to visual, hearing, or motor impairment, mental retardation, emotional disturbance, or environmental, cultural, or economic disadvantage (34 CFR 300.309).

The federal definition that governs the theoretical foundation of SLD emphasizes the idea of psychological processing disorders as underlying causes of learning disabilities. In several of the states that implement alternative definitions, processing disorders are also included. However, there is essentially a lack of classification criteria regarding the establishment of a processing disorder in the determination of SLD eligibility. Only 13 states require determination of a processing disorder as part of eligibility determination, and in these states little guidance is provided regarding how to determine a processing deficit. Ambiguity is noted in terms of those domains which should be assessed, the appropriate assessment tools to be used, and specific criteria to determine if a particular score or pattern was sufficient for determining eligibility for special education services. Six states include the term neurological impairment in the eligibility criteria, but no guidance is provided to the local education agency personnel regarding domains, assessment, or eligibility criteria. Conversely, 17 states included the establishment of a processing deficit as part of their classification criteria in 1994, which suggests a declining tendency regarding use of cognitive and/or perceptual disorders in eligibility determination.

When considering the achievement domains that may be used to identify a child as eligible for SLD, the following areas are unanimous across states: reading, mathematics, writing, oral expression, and listening comprehension. There is less agreement regarding subcategories within those broad domains, but virtually all states identify basic reading skills, reading comprehension, and mathematics calculation separately. Math reasoning is acknowledged exclusively in about half of the states. Some states allow SLD classification if the only discrepant area is spelling; and only one state (New Hampshire) formally recognizes nonverbal learning disabilities.

The federal regulation requiring a severe discrepancy between intellectual ability and academic achievement appears in the SLD classification criteria for 48 of the 50 states, with Iowa and Louisiana as the only states that do not have the discrepancy requirement in their state regulations. When examining the intellectual ability and achievement discrepancy model, determination methods vary widely (Reschly & Hosp, 2004). In order to avoid chance variations, the literature agrees that achievement must be lower than intellectual ability by a significant amount in order to determine that a difference is real. In addition, the achievement and ability scores need to be expressed on a common standard-score scale. Beyond these basic premises, there is wide disparity in the techniques used to determine if the discrepancy is genuine. Of the 48 states requiring an ability-achievement discrepancy, 31 state education agencies provide guidance to local education agencies regarding the specific method to use in order to calculate the difference between intellectual ability and achievement. Standard-score point differences, differences stated in terms of standard deviation (*SD*) units, and regression-prediction formulae are the most common methods used to calculate this difference.

In the three states that utilize the standard-score point difference, the intellectual ability-achievement discrepancy requirement is met if the students' IQ scores are above achievement scores in an academic domain that is specified by the state education agency by an amount equal to or greater amount than the stated magnitude (Reschly & Hosp, 2004). Discrepancy requirements in *SD* units are basically the same as those used in the standard-score point differences method. Using tests with a *SD* = 15, the common criteria of 1.0 *SD*, 1.5 *SD*, and 2.0 *SD* convert into 15, 23, and 30 points, respectively. Regarding the 10 state education agencies that establish discrepancy criteria in terms of *SD* units, the most common criterion is 1.5 *SD*, or about 23 points (Reschly & Hosp, 2004). The standard-score and *SD* unit discrepancies do not account for regression effects in determining expectations for level of educational achievement and severe discrepancy determination. The discrepancy-score distributions have *SD*s lower than 15 points, which creates inadvertent rigidity in the *SD* criteria.

The implementation of some form of a regression-prediction formula is the most commonly used discrepancy determination method. In most states, explicit formulae are provided to the local education agency personnel. Statistical or regression prediction formulae are recommended, but not required in two states and guidance is not defined on the required magnitude of the discrepancy. The decision about whether or not regression effects are incorporated into or are ignored in discrepancy determination may result in some difference in the nature of the SLD population.

Fundamentally no direction is offered to local education agencies in 17 of the 48 states in determination of intellectual ability-achievement discrepancies. There is no statement of how the discrepancy should be determined or how the guidance for discrepancy can be operationalized in 11 states. For example, in New York, the local education personnel are informed that a child with SLD shall exhibit “a discrepancy of 50% or more between expected achievement and actual achievement determined on an individual basis” (Reschly & Hosp, 2004). However, no further guidance is provided by the state education agency. In three states the determination process is explicitly delegated to the professional judgment of the team, with no further state guidance.

Regarding the magnitude of the discrepancy, 28 state education agencies with discrepancy requirements expect that all local education agencies in the state will employ the same numerical criteria to determine if a discrepancy is severe. The size of the required discrepancy varies from 15 to 30 points, with the most common criteria for a student with an IQ = 100 about 20 points, or an achievement of <80.

The next characteristic of the state education agency SLD discrepancy determination method and criteria that should be considered was whether or not a team override was permitted. The team's override process grants discretion to the multidisciplinary team to classify students as SLD even though they do not meet the established eligibility criteria. Team override is used with some frequency across the United States. Depending on the local education agency practices, team override can potentially be a significant influence in SLD identification. In 33 of the 50 state education agencies, the judgment by multidisciplinary teams to reject the findings of the evaluation in the determination of SLD classification is permitted. The variables that determine whether or not multidisciplinary teams override eligibility criteria have not been studied extensively, but these variables appear to be the perceived degree of need for the student and the assumed benefit of special education services. Pressure from general and special education teachers can contribute significantly. The reality that many teams exercise this override seems to be substantiated by results indicating that a significant number of children classified as SLD do not meet SEA eligibility requirements (Reschly & Hosp, 2004).

When considering the idea of team override, it is important to consider the implications of the referral process. The President's Commission on Excellence in

Special Education Report (2002) revealed that teacher referrals account for more than 80 percent of the students who are identified with high-incidence disabilities and placed in special education settings (Jordan, 2005). Teacher judgment is a significant factor in the identification and placement of students in special education. Achievement tends to be a strong predictor of referral for assessment or intervention. Approximately 55% of students are referred primarily for academic problems and 33% are referred with academic problems as a secondary issue (Hosp & Reschly, 2004). Because student referral is such a strong predictor of special education eligibility, significant differences in achievement between groups within the students in the population, raises the expectation of differential rates of identification for special education. For example, if African American students perform significantly lower than Caucasian students on achievement measures, African American students will be over identified even if selection criterion was applied consistently. The U.S. Department of Education cited that minority students were becoming the numerical majority of the public school population nationally. This trend is predicted to continue. Racially, ethnically, and linguistically different (RELD) students composed 32% of public schools in 1989, 39% in 1999, and 45% in 2009 (Ford, 2012). The increase in RELD students in public schools is not reflected in the teaching population, which remains extensively Caucasian. Cultural differences among students, families, and teachers are suggested as a major explanation for overreferrals and, ultimately, over representation. Differences in values, beliefs, attitudes, customs, and traditions contribute to low expectations and deficient thinking. These attitudes can, and often do, result in unwarranted referrals for special education evaluation and services.

Classification of Minority Students. The over representation of minority children in special education and the quality of their educational experience continues to be viewed as a significant issue (Vasquez et al., 2011). Disproportionate representation of minority students, particularly over representation of African American students, remains both controversial and unresolved (Colarusso, Keel, & Dangel, 2001). In the last 25 years, a record of over representation of minority children in special education in some school systems has been found to be evidence of discriminatory practice and infringement of students' civil rights (Coutinho & Oswald, 2000). Coulter (1996) examined the disproportionate representation of African Americans in special education and in gifted and talented programs. In one southern state, data were analyzed for 66 local education agencies. For the three "socially determined" disability categories (LD, SED, MR), African Americans were disproportionally over represented in 62 of the 66 local education agencies. Interestingly, disproportionality is less common in the disability categories of "orthopedic impairment," "deafness," and "visual impairment." Special education is under constant legal and personal examination in reference to the overrepresentation of African American and, to a lesser extent, Hispanic American students in high-incidence categories. According to the U.S. Department of Education's Office for Civil Rights, African American students represented 17.13% of public school students, yet 32.01% were identified as having an intellectual disability, 28.91% as being emotionally disturbed, 20.23% as having a specific learning disability, and 21.66% as being developmentally delayed. Hispanic Americans composed 20.41% of public school students; they are not overrepresented in most of the aforementioned categories. Results suggested 15.26% as having an intellectual disability, 11.10% as being emotionally disturbed, 20.98% as having a specific learning disability, and 11.16% as being developmentally delayed (Ford, 2012). The greatest overrepresentation was noted in African American males. On the contrary, the data indicated that, with the exception for LD, Hispanic Americans are underrepresented nationally.

Rigidity of Scores. The discrepancy method has been criticized for the use of rigid cutoff scores, which does not take into account profile variability, the relationship between ability and achievement measures, the standard error of measurement, and reasons for variable performance (Dombrowski, Reynolds, & Kamphaus, 2004). The discrepancy method relies heavily on a significant difference between the predicted or expected "ability" of a child and underachievement. However, this model fails to identify those children who have lower IQs due to profile variability and who also have lower achievement scores. Children with SLD often demonstrate profile variability and most achievement variance is accounted for by subtests, not factors, with the least amount of variance accounted for by a global composite (Hale et al., 2010). It is argued that this profile variability and limited achievement prevent global IQ interpretation for most children with disabilities. Although a child might exhibit discrepancy on one measure, he or she might not exhibit a discrepancy on another due to different technical characteristics of the measure, different construct coverage of the measures, or differences in administration and scoring (Hale, Wycoff, & Fiorello, 2011). Two children may have similar profiles and needs, but only a 1- or 2- point difference between the two of them may determine who receives services. Therefore, cutoff scores are essentially arbitrary numbers that essentially make SLD determination unreliable.

Complications Identifying Students At-Risk

Preferral Intervention Model: Wait-to-Fail Approach. The ability-achievement discrepancy model has also been criticized for not addressing children in need of early intervention. Because of this perception, the ability-achievement discrepancy model has been referred to as a "wait-to-fail" model due to the lack of preventative measures. No matter how significant the learning problem for young children from prekindergarten through 3rd and 4th grades, due to a wide range of expectations in the early grades, it is not uncommon for the students to demonstrate variability in IQ and achievement testing. This variability, although developmentally appropriate, does not allow for a statistical discrepancy between IQ and achievement to be demonstrated. Achievement test content becomes increasingly more complicated, relies more heavily on information acquired through reading, and places increased demands on higher-order cognition after the age of 9 (Hale et al., 2011). It is at this point that children with significant learning difficulties begin to flounder and can be identified for special education intervention (Hale et al., 2011). This wait-to-fail method frustrates educators because they are unable to offer early intervention and remediation through special education, although this time period is vital for basic skills remediation.

With the criticisms levied against the ability-achievement discrepancy model, other ways to identify struggling learners has been examined. The process for identifying and addressing learning needs of struggling students over the past several decades is generally seen in prereferral intervention models. This practice of prereferral interventions was in reaction to changes in the law which emphasized the fact that educators have to provide appropriate instruction to struggling learners. Additionally, documentation of the impact of that instructional practice on student progress must be included. This was in response to the 2001 President's Commission on Excellence in Special Education report, which suggested that many students who are placed in special education programs are instructional casualties and not students with disabilities (Hughes & Dexter, 2011). The Commission assumed the position that problems affecting students identified with LD are not necessarily deficits in the student, but rather the results of inappropriate or ineffective instruction. One of the contributions of the prereferral intervention approach is that schools were able to provide more early intervention than in the past. Providing early intervention alone may not be adequate in differentiating a student with SLD from a student that underachieves, particularly in reading, which requires more specialized instruction than that provided in many general education classrooms (Berninger, 2011). For example, if a student has an oral and written language learning disability, he or she will require direct instruction to facilitate word retrieval, morphological awareness, and inferential thinking, and not only phonological awareness. Without early diagnostic assessment, comorbid dysgraphia and/or dyscalculia may not be identified and treated during a period when students are more likely to respond to the writing instruction and instruction related to the reading and writing aspects of math (Berninger, 2011).

Prereferral models have received criticism due to inconsistencies in their terminology, involvement of team members in implementing interventions, or the extent to which the prereferral processes actually addressed learner needs (Hoover, 2010). Although well-intended, several inadvertent consequences resulted from both the prereferral practices and from terminology, leading to much confusion about ways to meet needs of struggling learners. As a result, the process and terminology associated with a prereferral intervention model unintentionally developed a situation in schools which limited educators and students in their efforts to prevent problems from becoming more severe.

The Response to Intervention Model and SLD identification

RTI Overview. A Response to Intervention (RTI) model, which was proposed as an alternative to the IQ-discrepancy method for identification of learning disabilities, also address concerns with ineffective instructional practices. Special language was incorporated into the 2004 revision of IDEA, which allowed RTI to be used as part of the disability identification procedure. According to Berkeley, Bender, Peaster, and Saunders (2009), 47 of the 50 states have developed an RTI model or are in the process of doing so. However, although states may try to implement RTI, it may be a different story at the local level or even within a particular school district building; they may be using differing levels of RTI. In most RTI models, consideration for special education services is a possible outcome for some students who fail to make adequate progress within tiered instruction. An underlying premise within RTI models is that an intrinsic disorder is presumed if a student continues to make inadequate progress (Klinger & Bianco, 2006). In its position paper, the Council for Exceptional Children (CEC) stated, "The RTI process is designed to identify struggling learners early, to provide access to needed interventions, and to help identify children with disabilities" (CEC, 2008, p. 74). The primary goal in RTI is the prevention and remediation of academic and behavior difficulties through effective classroom and supplemental instruction, including those provided by all entitlement programs. RTI is seen as a framework for effectively delivering and coordinating services in schools. The RTI framework provides data that are relevant to identification of SLD (Fletcher, Barth, & Stuebing, 2011). Kavale and Flanagan (2007) suggested that RTI has the potential to provide a more structured and rigorous prereferral process. This could lessen concerns with the previous prereferral models that were criticized for being a wait to fail approach, lacking data driven decisions.

Response to Intervention was noted as a shift from the prereferral intervention model as well as other models for identifying students eligible for special education services. An emphasis on prevention/early intervention is supported through the RTI model as opposed to waiting for the student to fail. Response to Intervention was hailed for its limited use or its lack of use of the ability-achievement discrepancy model, which had come under severe scrutiny since its inception. There is a greater reliance on actual achievement results, including rate of progress through this model. RTI emphasizes the use of curriculum-based measurement rather than standardized achievement tests to determine progress and implements universal screening for early identification of at-risk or struggling learners (Hoover, 2010). Previous research has indicated that the RTI model can reduce special education placements (Bender & Shores, 2008; Tucker & Sornson, 2007; Gresham, 2007) by providing early intervention and appropriate academic support for students. .

The components of an RTI model include scientifically-based core curriculum, universal screening, progress monitoring, and decisions about adequate progress in subsequent tiers (Hughes & Dexter, 2011). One of the cornerstones is the implementation of scientific, evidence-based Tier 1 instruction. The evidence-based instruction effectively eliminates inappropriate instruction as a reason for inadequate academic progress. For example, proponents of RTI indicate that early reading instruction should utilize a scientifically-based core curriculum such as one based on the National Reading Panel (NRP, 2000) report. This report highlighted the five components of effective early reading curriculum (phonemic awareness, phonics, fluency, vocabulary, and text comprehension) which should be incorporated to address reading progress and instruction adequately (Hughes & Dexter, 2011).

***Universal screening*.** The first step in identifying students at-risk for learning difficulties in the RTI model is through the process of universal screening. It is the mechanism for targeting students who struggle to learn even when presented with a scientific, evidence-based general education curriculum. Universal screening is typically implemented three times per school year. These screening procedures consist of brief assessments focused on target skills that are predictive of future outcomes. All students are screened in one or more academic areas in a typical RTI model. Students identified as at-risk for learning or behavior difficulties are provided additional evidence-based interventions in the identified academic area. However, screening students early in the learning process lends itself to two common errors: false positives and false negative (Hughes & Dexter, 2011). False positives occur when students are deemed at-risk, when, in fact, they are not. False negatives are determined when students are deemed not at-risk, but they perform poorly on a future criterion measure. In order for a prevention system to work efficiently, measures for determining risk need to yield a high percentage of true positives and limit the amount of false positives.

***Progress monitoring*.** Progress monitoring is used to evaluate student progress and performance in the at-risk areas previously identified through the universal screening process. Progress monitoring allows teachers and school personnel to determine the students who benefit from the typical instructional program, identify students who are not making sufficient improvement, and help direct the development and implementation of intervention programs for students who are not progressing (Hoover, 2010). After a student has been identified as an at-risk learner, the student's progress is monitored relative to Tier 1 instruction. Student progress is measured by comparing his or her expected rate of learning and actual rate of learning. Teachers can use these measurements to determine the effectiveness of meeting the needs of the individual student. If a student is not responding adequately to Tier 1 instruction, the student moves to Tier 2 which has increasingly intensive levels of intervention and instruction. In addition more frequent progress monitoring is supposed to occur. Progress monitoring can be implemented by a variety of methods; several of these methods have been reviewed by the National Center on Response to Intervention and the National Center for Student Progress Monitoring. However, these measures vary considerably in reliability, validity, and other key progress monitoring standards (Hughes & Dexter, 2011). RTI requires regular assessments but does not specify the nature or frequency (Johnston, 2010).

RTI and a Lack of Consensus

It has been suggested that RTI lacks a consistent means of determining appropriate response to intervention; the application of different methods identifies different children. The method is deemed unreliable and is criticized because it is inconsistently applied. The language of many state issued regulations related to the diagnosis of a learning disability under IDEA 2004 describes academic achievement as steadily being below grade level expectations. The findings of a lack of progress relative to peers when scientifically-based, empirically validated instruction has been implemented, is provided under RTI. However, few of these regulations clarify what it is that constitutes a peer group or offers any indication about how grade level standards are to be defined or determined. Regarding differences in achievement with peers, there are numerous factors to consider. Reynolds and Shaywitz (2009) postulated several questions regarding these factors. They questioned whether or not it should be age peers or grade peers and whether or not gender and other nominal variables are important in defining peer group. When factoring in the overrepresentation of boys receiving special education services, should boys be compared only with other boys? Does one define peer group achievement as the average level of progress of others in the same classroom, in the same school building, in the same school district, in the same state, or nationally, and are age or grade norms appropriate? What metric is best for determining a response to an intervention and how should it be chosen? Are raw scores utilized or should raw scores be converted to an equal interval scale? Is an age or grade corrected deviation standard score more appropriate? Each of these score types addresses a very different question with regard to changes in performance, and the type of score that is used will affect the student who has evidenced a response to intervention directly; these, therefore, will dictate the conceptual basis for identification of a student with a disability. The coverage of classifications based on an RTI approach is difficult to address because there is no gold standard for determining an inadequate response to intervention. This concern also applies to any identification approach to SLD, because identification will always depend on how the model is operationalized.

Additionally, when considering adequate progress in Tier 2, there is little consensus for determining response to instruction and when to proceed to Tier 3. Nonresponsiveness to Tier 2 interventions is critical in LD identification; however, there is no clear methodological definition of how or when a student should be identified as a nonresponder to intervention. This lack of clarity continues to be problematic for RTI as an identification tool because of the potential for inconsistent identification. At least six methods are currently used in the identification of nonresponders. Fuchs and Deschler (2007) defined five of these methods which include dual-discrepancy, median split, final normalization, final benchmark, and slope discrepancy. Vaughn, Linan-Thompson, and Hickman (2003) described a sixth method of identifying non-responders to Tier 2 intervention as exit groups. Depending on which method is employed, there is potential for variation in the number of students identified as nonresponders. As with any cut-point based criterion used to identify an aspect of SLD, the cut-points associated with these methods are arbitrary. The substantial variability between RTI models may produce threats to validity, measurement error, and in accuracy in identification (McKenzie, 2009). In a longitudinal reading study of first graders, Fuchs, Compton, Fuchs, and Bryant (2008) reported substantial variation between percentages of nonresponders based on which method was implemented (dual-discrepancy, 8.6%; median split, 9.8%; final normalization, 4.2%; final benchmark, 8.7%; slope discrepancy, 7.6%). For identification purposes, intervention response criteria should have some form of national standardization whenever possible (Fletcher, Barth, & Stuebing, 2011).

RTI Application With Minority Students

One of the additional, anticipated benefits of RTI is the potential to decrease the disproportionate placement of ethnic minority youth in special education. As previously noted, attention has been focused on successful and unbiased special education assessment and placement. Equitable assessment and placement in special education continue to be complicated by subjective, “soft” special education categories that entail clinical judgment in areas such as, mild mental retardation/cognitive disability, emotional disability, or specific learning disability. Although RTI could provide additional support regarding the presence of more subjective disabilities, questions remain about whether or not RTI will simply shift children into different “soft” categories rather than reducing overrepresentation more generally (Hernandez Finch, 2012). The impact of RTI on disproportionate placement may be rather different from state to state due to variation in the interpretation of laws. Specific to disproportional placement, there is concern that each state has its own requirements governing whether or not RTI is included and/or required in special education evaluations or within individual special education categories. Bouman (2010) conducted a survey of 142 school districts in California and found that districts that had implemented RTI did not have significantly lower placement rates than non-RTI districts. Bouman (2010) found that African Americans, Latinos, and Native Americans were overrepresented in the specific learning disability category, whereas the weighted risk ratio for European Americans was decreased. Asian Americans were significantly underrepresented, even in school districts that used RTI. Although fewer students were eligible for special education services for specific learning disabilities, disproportionate placement continued for individuals who were culturally and linguistically diverse but were increased for African American students.

Although RTI has shown promise, potential concerns have been identified regarding the role of RTI in the overall special education identification process. In the Council for Exceptional Children (2008) position paper, "RTI data does not provide sufficient data to rule out or identify a disability (p. 74)." Response to Intervention lacks sufficient validity as a sole diagnostic system for identifying learning disabilities (Kavale & Flanagan, 2007). In addition, challenges have been noted in the RTI implementation. These challenges have included ensuring the use of evidence-based instruction, the development of support structures necessary to assist all learners achieve satisfactory levels, and the clarification of how special education is defined within RTI (Kovaleski, 2007).

Inconsistent Approach of RTI

A key component of RTI is the removal of IQ and the severe discrepancy component of LD diagnosis from consideration, especially as it relates to diagnosis of a learning disability. The Office of Special Education and Rehabilitative Services never clearly defined what is intended by the term severe discrepancy. Each state education agency and, in most cases, each local education agency was free to develop and use their own method. Therefore, there was great variability in how severe discrepancies were determined and there were also numerous inconsistencies at both the state and local levels. There is now a similar situation with the regulations' lack of guidance in assessing whether or not RTI has occurred. It has been argued that RTI, in fact, is another form of discrepancy analysis, between the response of an individual student and his or her class or some other designated comparison group (Reynolds & Shaywitz, 2009). This comparison group, like the discrepancy model, may also vary across jurisdictions. There are many issues in determining gain scores under RTI models and these issues are potentially even more complex than those surrounding IQ-achievement discrepancy models. Many variations of how to approach such comparisons have been offered with varying levels of mathematical complexity. Determining a response to intervention in single cases can be mathematically complicated, potentially even more so than in discrepancy models. It is suggested that there will be numerous applications that produce different results and identify children under the different nonconsensual models that are in use (Reynolds & Shaywitz, 2009).

The lack of consensual, scientific resolution will unavoidably cause clinicians in different settings to identify very different groups of kids who are in need of or are eligible for special education services. In addition, clinicians are more likely to fail to identify different groups of students who are struggling readers. Furthermore, which students are identified is important for numerous reasons, including instructional effectiveness, availability of related services, various accommodations in school, and disability status in a multitude of Federal and state programs.

The term learning disability has referred to and is currently conceptualized as an unexpected difficulty in learning in one or more of the identified areas of academic achievement, but it has most commonly occurred in the domain of reading. The approach and definition embedded in RTI has the possibility of eliminating the basic concept of learning disability as it was intended to do and as it is currently understood if followed to its definitive conclusion. Given the progress that has been made in the field of neuroscience, this would be an adverse outcome. With the advent of functional brain imaging, it became possible to observe different neural systems at work in typical and in learning disabled readers.

Response to Intervention as a diagnostic model is lacking not only in diagnostic coverage and validity, but it also presents limited evidence directing what to do as far as academic instruction is concerned after a child fails to respond. One of the major reasons for a comprehension evaluation is to develop hypotheses about a student's cognitive profile that would allow the implementation of diverse and more effective classroom instruction. The evidence is apparent that remedial efforts focused on nonacademic process variables are not effective (Reynolds & Shaywitz, 2009). Teaching practices for academic deficits that have been tried with a student and have been demonstrated as ineffective should be modified accordingly or discontinued altogether. The elimination of an evaluation of cognitive abilities and psychological processes appears to revert to a one size fits all mentality which assumes that all children fail for the same reason. For example, a model suggesting that remediation of phonological awareness deficits will remedy virtually all students with reading problems have proven to be incorrect. Many children whose phonological skills have been remediated, and remediated appropriately, continue to demonstrate difficulty reading fluently and comprehending what they have read. Only through a comprehensive assessment of the complete degree of a student's cognitive strengths and weaknesses and psychological abilities and processes, insights into the underlying causes of reading difficulties can be discovered and then specific interventions can be implemented to target each student's individual needs.

There are numerous convincing reasons to perform real comprehensive assessments of students who fail RTI and yet not to declare RTI as a comprehensive assessment. In order for RTI to be effective, the interventions need to be customized to the needs of the individual student. Knowing the individual needs and how to remediate them comes from a comprehensive assessment. The current focus of RTI leads to a constricted assessment of academic skills, which is inadequate for identification and intervention of learning disabilities (Reynolds & Shaywitz, 2009). As an approach to diagnosis, RTI does not have confirmed value either as a rule out or as a rule in process for a disability. A student who does RTI successfully may have a disability. This is notably the case in situations in which the student is superior to classmates in ability or achievement. Conversely, a student who fails in RTI may or may not have a disability but the nature of the disability is unknown. A failed RTI is neither a necessity, nor a sufficient condition for determination of the existence of a learning disability. In addition, it has been suggested that students who are higher functioning cognitively, but still have processing strengths and weaknesses that adversely affect achievement, would be overlooked if an RTI-only approach were used for identification (Hale et al., 2010). Failure to respond to intervention cannot differentiate between those with SLD and those who are low achieving for some other reason; neither would it consider high ability students who demonstrated significant processing and achievement deficits as being students with SLD (Hale et al., 2010).

One of the contributions of the RTI approach is that schools are providing more early intervention than in the past. Providing early intervention alone may not be sufficiently adequate to identify SLD, particularly in reading, which requires more specialized instruction than that provided in many general education classrooms (Berninger, 2011). For example, if a student has an oral and written language learning disability, he or she will require direct instruction to facilitate word retrieval, morphological awareness, and inferential thinking, and not only phonological awareness. Without early diagnostic assessment, comorbid dysgraphia and/or dyscalculia may not be identified and treated during a period when students are more likely to respond to the writing instruction and instruction related to the reading and writing aspects of math (Berninger, 2011).

The Third Method and SLD identification

Basic Psychological Processes. The use of processing strengths and weaknesses allows for recognition of the SLD statutory requirements, and is consistent with the "third method" approach. A strengths and weaknesses model makes good empirical, clinical, and legal sense because it ensures that students identified as SLD demonstrate one or more processing deficits that interfere with academic achievement (Hale et al., 2010). Examining a pattern of strengths and weaknesses would appear to be preferable, especially when considering that the statutory definition of SLD specifies that a specific learning disability means a disorder in one or more of the basic psychological processes. Because the SLD definition specifies a disorder in the basic psychological processes, these processes are related to the suspected disability (Hale, Flanagan, Naglieri, 2008). The term cognitive process refers to a foundational, neuropsychologically identified ability that provides the means by which an individual functions in this world (Naglieri, 2011). A specific cognitive process provides a unique ability to function, but a group of cognitive processes are needed to meet the demands of our complex environment. Having several cognitive processing abilities is necessary for the capability of completing the same task using different types or various combinations of processes. Cognitive processes underlie all mental and physical activity and allow humans to acquire all types of knowledge and skills (Naglieri, 2011). It is important to recognize that skills, such as decoding or math reasoning, are not examples of cognitive processes themselves. They are sets of specific knowledge and skills that are acquired through the application of cognitive processes. The interaction of basic cognitive processes with instruction leads to learning and social competence.

Basic psychological processes are assessed via measures of memory, processing, attention, visual auditory, sensory-motor, mental control, problem solving and/or language use, based upon the student's strengths and weaknesses (Flanagan et al., 2013). The focus of measuring psychological processes is not necessarily on the full scale or overall measure of intellectual functioning; the focus is rather on index area scores. These areas are most closely connected with the areas of processing and consist of multiple subtests in order to increase the reliability of the evaluation (Flanagan et al., 2013). This assessment approach has been adopted by the integrated school neuropsychological/Cattell-Horn-Carroll (SNP/CHC) model (Miller, 2013), which breaks the psychological processing demands into broad, second-order, and third-order classification. These processing demands are assessed in the following domains: Basic Sensorimotor Functions; Visualspatial; Auditory/Phonological; Learning and Memory; Executive Functions; Allocating and Maintaining Attention; Working Memory; Speed, Fluency, and Efficacy; General Intellectual Functioning; and Acquired Knowledge (e.g., language, reading, writing, and math). Naglieri (2011) pointed out that the distinction between cognitive processes and knowledge and skills is critical for an effective assessment of basic psychological processes. An assessment of achievement requires tests that adequately evaluate the domain of interest (e.g., reading, writing, math, etc.). In order to maximize the extent to which scores reflect processing construct effectively, an assessment of cognitive processes must be conducted using tests that are as free from academic content as possible. It is important to tease out assessment tools that use a combination of academic skill and processing. Achievement domains are defined effectively by the content of the test, but processing tests are defined by the cognitive demands of the task. Because of this, Naglieri (2011) argued that cognitive processes should not be defined by the content or modality of the task. For example, sequential processing can be given visually or orally because the underlying cognitive processing demand is the same, regardless of the modality.

IDEA 2004 describes several important criteria for a comprehensive evaluation that should be used for SLD eligibility. A variety of assessment instruments and strategies must be used to collect relevant information about the student. The use of any single measure or assessment tool as the sole criterion for determining whether or not a student has SLD is not permitted. The assessment instrument must also be technically sound. In addition, assessments must be selected and administered to avoid discrimination on the basis of race or culture, and the tests should be administered in a form most likely to yield accurate information. The measures must be reliable and valid for the purposes for which they were intended. Because IDEA specifies that children must have a disorder in one or more of the basic psychological processes, which is the underlying cause of SLD, cognitive processes should be measured. A comprehensive evaluation of the basic psychological processes unites the statutory and regulatory components of IDEA 2004 and ensures that the methods used for identification more closely reflect the definition (Naglieri, 2011). Any defensible eligibility system would stipulate continuity between the statutory and regulatory definitions; because of this, SLD determination requires the documentation of a basic psychological processing disorder.

Discrepancy/Consistency Model for SLD Diagnosis. Luria's theoretical description of how the human brain functions stressed the fact that no area of the brain functions without input from other areas so that cognition and behavior result from an interaction of complex brain activity across various areas (Naglieri, 2011). Luria's research on the functional aspects of the brain provided the basis for the neuropsychological processing theory of intelligence called PASS, which was described by Das, Naglieri, and Kirby (1994). The four PASS processes represent a combination of cognitive and neuropsychological constructs such as executive functioning (Planning and Attention), selective, sustained, and focused activity (Attention), processing of information into a coherent whole (Simultaneous), and serial processing of information (Successive). The Planning scale measures mental processes for determining, selecting, applying, and evaluating problems. Performance on this scale is dependent on retrieval of knowledge and impulse control, and is reflective of prefrontal lobe functions (Semrud-Clikeman & Teeter Ellison, 2009). Attention is a cognitive processing ability that is associated with Luria's first functional unit, which allows an individual to selectively focus cognitive activity toward a stimulus over a period of time without being distracted by other competing stimuli (Naglieri, 2011). Simultaneous processing is needed for organizing information into groups or a coherent whole. The ability to recognize patterns as interrelated elements is made possible by the parietooccpital temporal regions (Semrud-Clikeman & Teeter Ellison, 2009)). The examination of Simultaneous processing is achieved using tasks that are described as involving visual-spatial reasoning. These types of tasks are found in progressive matrices tests. Simultaneous processing is not limited solely to nonverbal content. This type of processing plays an important role in the grammatical components of language and comprehension of word relationships, prepositions, and inflections (Naglieri, 2011). The Successive scale measures the ability to integrate stimuli in a sequential, serial order. Successive processing is needed when working with stimuli arranged in a defined serial order. Successive processing is an integral ability involved with the serial organization of sounds, such as learning sounds in sequence and early reading. Young children with poor Successive processing often have difficulty following directions or comprehending what is being said to them when sentences are too lengthy.

Naglieri (1999) suggested that evidence of a disorder in one of the four PASS basis psychological processes should be based on a cognitive weakness because the student's ipsative weakness is evidence of a specific disorder in processing. The performance is considered unusual because the score is low relative to a national norm. Furthermore, the student must have deficient academic performance in a specific area to be considered eligible for programming for children with a specific learning disability. The model includes a significant discrepancy between the student's high cognitive processing scores and low academic achievement in a specific area, a significant discrepancy between the student's high and low cognitive processing scores, and consistency between the student's low processing and low achievement scores. The goal of the Discrepancy/Consistency Model for identification of specific learning disabilities, which was developed for use with the Cognitive Assessment System (CAS; Naglieri & Das, 1997), is to obtain systematic examination of variability of both cognitive and academic achievement test scores (Naglieri, 2011). Determining whether or not cognitive processing scores differ significantly is accomplished through the application of an ipsative method. This method determines when the student's scores are reliably different from the student's average score. In the Discrepancy/Consistency Model, the ipsative approach is applied to the PASS scales. The PASS scales represent four neuropsychologically defined constructs, not the subtests as is typically done with Wechsler scales (Naglieri, 2011). This changes the method from one that demands considerable clinical interpretation of the meaning of subtest variability to analysis of scales that have been theoretically defined and have higher reliability and validity (Naglieri, 2011).

The WISC-IV Administration and Scoring Manual (Wechsler, 2003b) provide values needed to compare the Verbal Comprehension, Perceptual Reasoning, Working Memory, and Processing Speed Index scores. The manual provides values needed for significance when comparing all possible pairwise combinations of the four scales. However, differences among the scales are examined after the results are obtained. This means that the practitioner is making six pairwise comparisons simultaneously. When more than one comparison is being made concurrently, the statistical probability of obtaining a significant difference is increased by a multiple of the number of comparisons made (Naglieri & Paolitto, 2005). When a practitioner uses the corresponding table in the administration and scoring manual to determine whether any of the combinations of index scores are significantly different using the .05 level, the experimentwise error rate is actually .265 because six pairwise comparisons have been made (Naglieri & Paolitto, 2005). The ipsative approach is an alternative to the pairwise comparison approach that maintains the overall error rate and provides a more efficient way to examine intra-individual difference. The ipsative method provides the values needed to make comparisons between an individual's scores on separate scales within a test to the average of those scores. The advantage of using the ipsative approach to compare the four WISC-IV scores is that rather than making six pairwise comparisons, each of the four index scores is compared with the child's mean score. This method allows for a reduction in comparisons and enables the practitioner to compare a student to his or her overall personal level of performance, thereby suggesting individual strengths and weaknesses in his or her profile.

Naglieri and Paolitto (2005) computed the ipsative values for the WISC-IV Index scores utilizing Davis's (1959) formula for the difference between the averages of several scores obtained by one individual and each of his or her scores included in the average. Silverstein's (1982) modification of this procedure was applied to correct the *z* value used to compute the differences needed for significance, based on the number of comparisons made to the mean. In order to use the ipsative values provided by Naglieri and Paolitto (2005), several steps are required. First, the practitioner must calculate the average of the four obtained WISC-IV scale standard scores. Second, this mean must be subtracted from each of the individual Index scores to obtain a deviation score. Third, the ipsative values corresponding to the student's chronological age and level of significance desired must be obtained. Fourth, if the deviation score is equal to or greater than the ipsative value provided, then the variation is significant. Positive significant values should be considered a strength, and negative values should be considered a weakness in the student's profile.

Operational Definition of SLD. One of the third method approaches for the identification of SLD is the Dual Discrepancy/Consistency (DD/C) Operational Definition of SLD, which was developed by Flanagan and colleagues (2002, 2006). The method consists of three broad levels of evaluation that attempt to identify normative strengths and weaknesses in academic and cognitive abilities and processes and to understand the relationships among them (Flanagan, Fiorello, & Ortiz, 2010). Level 1 of the operational definition involves documenting the fact that some type of learning difficulty exists in one or more areas of academic achievement. The process at Level 1 involves a comprehensive assessment of the major areas of academic achievement (e.g., reading, writing, math, and language). The areas generally assessed at this level include the eight areas of achievement specified in the federal definition of SLD. Most of the skills and abilities measured at this level represent an individual's stores of acquired knowledge (e.g., Quantitative Knowledge [*Gq*], Reading and Writing Ability [*Grw*], and Vocabulary Knowledge [*Gc*-VL]). Following the evaluation, the practitioner must determine whether or not the student has a weakness or deficit in one or more specific academic skills. This is typically done by making normative-based comparisons of the student's performance against a representative sample of same-age or same-grade peers from the general population (Flanagan, Alfonso, & Mascolo, 2011). When weaknesses or deficits in academic performance are found, the process advances to Level II.

Level II involves evaluating whether or not any documented weaknesses or deficits found in Level I are primarily the result of external factors (e.g., cultural and linguistic differences, lack of motivation, medical issues, sensory concerns, social/emotional disturbance, etc.), or are noncognitive in nature. At Level II, the practitioner must judge the extent to which any factors other than cognitive impairment can be considered as the primary reason for the academic performance difficulties (Flanagan et al., 2011). If performance is not attributed primarily to other factors, then the second criterion is met and the assessment may continue to the next level. Examination of exclusionary factors is necessary to ensure an impartial and equitable interpretation of the data collected for SLD determination. This is not intended to rule in SLD, and through vigilant examination of exclusionary factors, the practitioner can rule out other possible explanations for deficient academic performance.

The criterion in Level III is similar to that of Level I, except that data from an assessment of cognitive abilities, neuropsychological processes, and learning efficiency is evaluated. A prominent aspect of the CHC-based operational definition of SLD is the concept that a weakness in a cognitive ability or process underlies difficulties in skill development and academic performance. Data analysis at this level attempts to make sure that identified weaknesses or deficits on cognitive tests demonstrate an empirical relationship to those weaknesses in academic skills identified previously (Flanagan et al., 2011). Prior to selecting cognitive and neuropsychological tests, the practitioner should have knowledge of the cognitive abilities and processes that are most important for understanding academic performance in the areas in question. Flanagan et al. (2011) suggest that the evaluation of cognitive abilities and processes should be comprehensive in the areas of suspected dysfunction; evidence of a cognitive weakness is a necessary condition for SLD determination. If criterion is met, the process continues to Level IV.

Level IV of the evaluation investigates a pattern of strengths and weaknesses characterized by dual discrepancy/consistency. Level IV focuses on a theory and research guided examination of performance across academic skills, cognitive abilities, and neuropsychological processes to determine whether or not the student's underachievement is unexpected or consistent with the SLD construct (Flanagan, Ortiz, & Alfonso, 2013). In the context of DD/C operational definition of SLD, the term cognitive aptitude refers to the specific cognitive ability or neuropsychological processing weaknesses that have an established empirical relationship to the academic skill weakness. When the process of SLD identification has reached Level IV, three necessary criteria have already been met: (1) one or more weaknesses in academic performance; (2) one or more weaknesses or deficits in cognitive abilities and/or neuropsychological processes; and (3) exclusionary factors were determined not to be the primary causes of the academic and cognitive deficits. At this point, it is important to determine if the pattern of results supports the notion of unexpected underachievement. The nature of unexpected underachievement suggests that not only does the student have below-average aptitude-achievement consistency, but that these weaknesses exist along with average or above average overall intelligence (Flanagan et al., 2010). The discovery of consistencies among cognitive abilities and/or processes and academic skills in the below-average (or lower) range could result from intellectual disability or generally below-average cognitive ability. Therefore, SLD identification cannot be based on below-average aptitude-achievement consistency alone. This consistency is a necessary marker for SLD because SLD is caused by cognitive processing weaknesses or deficits. Therefore, there is a need to understand and identify underlying cognitive ability or processing problems and determine if they significantly contribute to the student's academic difficulties (Flanagan et al., 2013). The student must also demonstrate evidence of average or better functioning (i.e., standard scores $\geq$ 90) in cognitive and neuropsychological domains that are not highly correlated with the presenting problem (Flanagan et al., 2011).

When the student has met the criteria for SLD diagnosis, it is typically noticeable that the student has difficulties in daily activities that need to be addressed. The purpose of Level V is to determine whether the identified condition (i.e., SLD) adversely impairs academic functioning and educational performance enough to warrant special education services. IDEA requires a determination that the identified disability results in some negative or adverse impact on educational performance or functioning. Students with SLD may require individualized instruction, accommodations, and modifications based on a variety of factors (e.g., academic setting, severity of disability, developmental level of the student, and delivery of instruction). Some students with SLD may not require special education services, particularly when their academic needs can be met through differentiated instruction and other classroom-based accommodations. On the other hand, some students with SLD may require classroom-based accommodations and special education services. Furthermore, in cases in which the student with SLD is significantly impaired, other placement options that will best meet his or her academic needs adequately should be considered. At this level, there are two possible questions that need to be considered. First, can the student's academic difficulties be remediated, accommodated, or compensated for without individualized special education services? If the answer is yes, then services may be provided and their effectiveness monitored. If the answer is no, then the multidisciplinary team must answer the question, “What is the nature and extent of the special education services that will be provided to the student?”

Concordance-Discordance Model. Rather than using the heavily criticized ability-achievement discrepancy model, the Concordance-Discordance Model has been developed for use in the Cognitive Hypothesis Testing (CHT) approach as an alternative for serving and identifying students with SLD (Hale & Fiorello, 2004). This method represents a more accurate way to identify children with learning disabilities and has the potential to lead to more effective interventions because the model allows the team to identify each student’s cognitive strengths and weaknesses (Hale & Fiorello, 2004). When determining whether or not a student meets the criteria, a concordance between the deficient achievement area and neuropsychological process not related to the achievement area in question must be documented. Second, discordance between the deficient achievement area and neuropsychological process not related to the achievement area must be established. Last, discordance between processing strengths and weaknesses need to be identified. A comprehensive CHT assessment may expose deficits on given measures and good performance on other measures. Composite weakness and strength cluster scores for the student could be created through these subtest scores. Based on these scores, the student should exhibit a significant difference (in terms of standard error of the difference) between the strength cluster and the weakness cluster, and a significant difference between the strength cluster and the achievement deficit, but no significant difference between the weakness cluster and the achievement deficit score. After the deficit areas in both processing and achievement have been identified, a processing area unrelated to the achievement deficit must be found. At this point, the student has both concordance and discordance. In the CHT model, if no processing weaknesses associated with academic deficits are documented, then the difficulties may be primarily the effect of other causes. If other processing areas thought to be unrelated to the deficient academic area are also deficient, then the student would be considered a low achiever, because all skills would be low.

The C-DM model places on emphasis on standard error of the difference (SED). The SED takes into account the reliability of the measures being compared and requires the same standard deviation (SD) for each score. However, the SED does not take into account the correlation of the measures (Hale & Fiorello, 2004). The SED is defined as follows: SED = SD * SQRT(2 – r_{xx} – r_{yy}). The r_{xx} is the reliability of the first subtest and the r_{yy} is the reliability of the second subtest at the same age level. The outcome is the critical value of the SED, and in order for this to be significant, the SS difference must exceed this value. In order to use 99% or 95% confidence interval, the SED must be multiplied by 2.58 ($p = .01$) or 1.96 ($p = .05$) to obtain the critical value. Test reliability and errors of measurement are particularly important to consider when evaluating the differences between two scores (Anastasi & Urbina, 1997). By examining the range within which each score may fluctuate, one can check against overemphasizing small differences between scores. Such caution is advantageous both when comparing test scores of different people and when comparing the scores of the same person in different abilities. In addition, it is important to know if the score differences have resulted merely from the chance selection of specific items in the particular verbal, numerical, and mechanical tests employed. It is critical to keep in mind that the standard error of the difference between two scores is larger than the error of measurement of either of the two scores. This is attributed to the fact that this difference is affected by the chance errors present in both scores.

The eight-step C-DM process is designed to ensure that any student classified with SLD meets the IDEA statutory and regulatory SLD requirements (Hale, 2006). Each step in the C-DM model has a clinical objective along with clinical questions/decision rules. The first objective is to score the standardized cognitive test and determine whether the global composite score (e.g., IQ), factor scores, or subtest scores should be interpreted. If all subtest scores are consistent enough to interpret a global composite score, then C-DM is unlikely and the student probably is not SLD. Other possible measures of processing deficits may be considered and administered if necessary. If the scores are not consistent, C-DM is possible and the examiner has to determine if the subtest scores are consistent within factors to interpret factor scores. If the answer to this question is yes, C-DM is possible and the practitioner should proceed to the next step. If the answer is no, the practitioner should consider subtest combinations to form a new factor score within a cognitive measure. If no subtest combinations appear to represent a new factor, the practitioner should determine if other standardized measures can be added to the cognitive measure in order to create new factor scores.

The second step of C-DM involves the scoring of the standardized achievement test and an examination to determine if composites or subsets indicate achievement deficit. The evaluator must determine if the standardized achievement scores indicate an academic deficit that is consistent with prior evaluation, classroom performance, and teacher-reported achievement deficits. If the answer is yes, the practitioner would proceed to step 3. If the answer to the question is no, then the examiner should explore other causes for poor test performance, or explanations for poor performance in the classroom and consider retesting for achievement to confirm or contest the achievement deficit.

If the student meets the criteria listed in the first two steps, then the practitioner needs to review cognitive and/or neuropsychological literature to ensure that the obtained cognitive deficits are associated with achievement deficits. The critical question for step 3 focuses on whether or not the obtained cognitive deficits interfere with the deficient academic area. If the cognitive and/or neuropsychological deficits are related to the deficit achievement area, then the practitioner would proceed to step 4. If the answer is no, then C-DM is unlikely. The practitioner should check the ecological validity of cognitive and achievement deficits. At this point, the practitioner should return to step 2 or should discontinue.

It is critical for the practitioner to acquire the reliability coefficients for cognitive strengths, cognitive deficits, and achievement deficits. If the factor/subtest reliability coefficients (e.g., coefficient alpha) are available in the cognitive and achievement technical manuals, then the practitioner should calculate the standard error of the difference in order to establish discordance between cognitive strength and cognitive deficit. If the reliability coefficients are not available, new factor scores and reliability coefficients must be computed. This can be done by averaging factor scores and reliability coefficients for new factors, utilizing Fisher's z-transformation (Hale & Fiorello, 2004). The reliability coefficients are then entered into the SED formula. The

SED should be multiplied by 1.96 for $p < .05$, or 2.58 for $p < .01$. If the difference between cognitive strength and weakness is greater than the SED critical value, then there is evidence of a significant difference between cognitive strength and deficit. Therefore, the student likely has a deficit in the basic psychological processes that is interfering with academic achievement. If there is no significant difference, then the practitioner must consider other possible cognitive deficits for the achievement deficit and return to Step 1. It is possible that the student may have another disability interfering with achievement and further evaluations may be warranted. The student may not have SLD and may be better served with an intensive response-to-intervention model.

After calculating the standard error of the difference for the cognitive strengths and deficits, the SED formula has to be applied to establish discordance between cognitive strength and achievement deficit. The reliability coefficients for cognitive strength and academic deficit are placed into the SED formula. The value is multiplied by either 1.96 or 2.58. If the obtained difference between cognitive strength and academic deficit is greater than the SED critical value, then there is a significant difference between cognitive strength and deficit. The student likely has unexpected underachievement consistent with SLD. If the difference is not significant, then once again the evaluator must consider other possible cognitive and/or achievement deficits.

After establishing discordance between cognitive strength and deficit, and discordance between cognitive strength and achievement deficit, the practitioner must calculate the SED formula to establish concordance between cognitive deficit and achievement deficit. After calculating the SED critical value, the practitioner has to once again determine if the obtained difference is significant. If there is no significant difference between the cognitive deficit and the achievement deficit, the cognitive deficit is a plausible cause for the achievement deficit. At this point, a classification of specific learning disability should be considered and an individualized education program should be developed for the student. If the achievement deficit is significantly below the cognitive deficit, this could mean other factors are causing additional impairment. Classification for SLD should still be considered, but additional evaluations may be necessary in order to determine the reasons why the achievement deficit is substantial. If the achievement deficit is significantly above the cognitive deficit, it could mean that the student is using a compensatory strategy to achieve a better score on the academic measure. The results should be reviewed closely to determine if a classification of SLD is warranted.

Last, the practitioner must determine whether or not C-DM findings have ecological validity and team consensus for SLD or another classification determination must be ensured. The practitioner should reexamine empirical literature, RTI data, teacher reports, classroom performance, classroom observations, and other evaluation data to determine whether the student meets IDEA statutory and regulatory requirements of SLD or for other disorders warranting special education services.

C-DM Factors. Hale and colleagues (Hale & Fiorello, 2004; Hale et al., 2003; Hale et al., 2008) identified ten areas of cognitive strengths along with fifteen areas noted as cognitive weaknesses. Cognitive strengths consist of the Verbal Comprehension Index and Perceptual Reasoning Index, along with eight created factors. These factors are defined as Gc (Similarities and Vocabulary), Gc/Expressive Language (Vocabulary and Comprehension), Gf (Picture Concepts and Matrix Reasoning), Gv/Problem Solving

(Block Design and Matrix Reasoning), Gv/Analysis-Synthesis (Block Design and Picture Completion; Block Design and Symbol Search), LTM Visual Memory/Object Identification Recognition (Picture Concepts and Picture Completion), Concept Formation (Similarities and Matrix Reasoning), and Convergent Thought (Similarities and Picture Concepts). The cognitive weaknesses are identified in the Verbal Comprehension Index, Perceptual Reasoning Index, Working Memory (Executive Working Memory – Digit Span Backwards and Arithmetic; Auditory Working Memory – Digit Span Backward and Letter-Number Sequencing), Processing Speed Index, Executive (Working Memory Index and Processing Speed Index; ACID profile), Gc, Gc/Expressive Language, Gf, Gv/Problem Solving, Gv/Analysis-Synthesis, LTM Visual Memory/Object Identification Recognition, Concept Formation, Convergent Thought, and Alphabetic Principle (Digit Span and Coding).

Assessment Instruments

WIAT-II and WIAT-III. The standardization sample of the WIAT-II consisted of the age-based sample of students age 4-19 (N = 2,950), grade based sample PreKindergarten-12th grade (N = 3,600) and college/adult sample grades 13-16 (N = 707) from two- and four- year colleges, and ages 17-89 (N = 500). Split-half reliability coefficient procedures were used for the WIAT-II as a measure of internal consistency. Prekindergarten to grade 12 mean split-half reliability coefficients ranged from .80 (Listening Comprehension) to .97 (Word Reading, Pseudoword Decoding) and Composite scores from .89 (Oral Language) to .98 (Reading). The Total composite mean coefficient was .98. The WIAT-III age range, 4 years through 50 years, is narrower than that of the WIAT-II. The WIAT-III was standardized on a nationally stratified sample of

2,775 students in grade-based sample (PreKindergarent-12th grade) and 1,826 students in the age-based sample (aged 4:0-19:11). The internal consistency reliability of the WIAT-III, using split-half reliability coefficients indicate average reliability values in 0.90s for Math Problem Solving, Word Reading, Pseudoword, Numerical Operations, Oral Reading Fluency, Oral Reading Rate, and Spelling. Average reliability coefficients for Listening Comprehension, Early Reading Skills, Reading Comprehension, Sentence Composition, Essay Composition, Oral Expression, and Math Fluency subtests are predominantly in the 0.80s and 0.90s. WIAT-III subtest reliabilities are comparable to the WIAT-II subtest reliabilities.

The WIAT-III retains several features from its predecessor. The new edition preserves and updates many of the same subtests included on the WIAT-II and maintains content coverage in the areas of listening, speaking, reading, writing, and mathematics. Several subtests were updated with standard revisions, such as added and modified items, art, and/or administration instructions, but retain the basic structure and administration format as in the WIAT-II. These subtests include Spelling, Numerical Operations, Math Problem Solving, Word Reading, and Pseudoword Decoding. The Reading Comprehension subtest has updated comprehension questions and scoring rules and one new passage. The subtest no longer includes the supplemental scores from the WIAT-II (target words, reading speed). The Listening Comprehension subtest includes Receptive Vocabulary and Oral Discourse Comprehension. The Oral Expression subtest includes Expressive Vocabulary, Oral Word Fluency, and Sentence Repetition. The Alphabet Writing Fluency, Sentence Composition, and Essay Composition subtests are based upon components of the WIAT-II Written Expression subtest. Five new subtests were added to the WIAT-III: Early Reading Skills, Oral Reading Fluency, Math Fluency – Addition, Math Fluency – Subtraction, and Math Fluency – Multiplication. The WIAT-II included five composites: Total, Oral Language, Written, Language, Mathematics, and Reading. The WIAT-III includes eight composites: Total Achievement, Oral Language, Written Expression, and Mathematics, which are similar to their WIAT-II counterparts and Total Reading, Basic Reading, Reading Comprehension and Fluency, and Math Fluency, are the new composites.

Federal regulations specify several criteria for determining the existence of a specific learning disability, including underachievement in one or more areas, failure to make sufficient progress in response to targeted intervention, and a pattern of strengths and weaknesses in performance, achievement, or both. Similar to the WIAT-II, the WIAT-III provides the capability of conducting an ability-achievement discrepancy analysis, using either the simple difference or predicted achievement method. The WIAT-III also includes the capability of conducting a pattern of strengths and weaknesses discrepancy analysis, which most closely resembles the Concordance-Discordance Model of SLD identification (Lichtenberger & Breaux, 2010).

WJ-III NU ACH. The Woodcock-Johnson III Normative Update (WJ III NU) is a recalculation of the normative data, based on 2005 U.S. Census statistics and updated norm construction procedures, for the Woodcock-Johnson III (WJ III). The WJ III NU consists of two distinct, co-normed batteries: the Woodcock-Johnson III Tests of Cognitive Abilities (WJ III COG) and the Woodcock-Johnson III Tests of Achievement (WJ III ACH). The WJ III ACH includes 22 oral language and achievement tests in Forms A and B. The two major parts of the WJ III NU are co-normed. The WJ III NU batteries are designed for use with subjects from preschool to geriatric levels. Normative data for the WJ III NU are based on a carefully selected sample of 8,782 subjects from more than 100 geographically diverse U.S. communities. The preschool sample (ages 2 to 5 and not enrolled in kindergarten) was composed of 1,153 subjects. The kindergarten through 12th grade sample was composed of 4,740 subjects. The total adult sample consisted of 2,889 subjects, including 1,727 adults not attending college and 1,162 undergraduate and graduate students. According to McGrew et al. (2007), the reliability characteristics of the WJ III NU meet or exceed basic standards for both individual placement and programming decisions. The interpretive plan of the WJ III NU emphasizes cluster interpretation; of the median cluster reliabilities reported, most are .90 or higher. Of the median test reliabilities reported of individual test scores, most are .80 or higher and several are .90 or higher.

Differential Ability Scale-2 (DAS-2). The Differential Ability Scale comprises a cognitive and achievement scale and was developed for children and adolescents. The DAS-2 was designed to measure profiles of cognitive abilities as well as differences between cognitive and achievement abilities. The DAS-2 consists of a General Conceptual Aptitude (GCA), which is broken down by age group. The GCA is typically divided into Verbal Ability and Nonverbal Reasoning Ability. The GCA has an additional component (Spatial) for children between the ages of 6-0 and 17-11. The normative sample for the DAS-2 includes children who are learning disabled, speech-language impaired, cognitively retarded, gifted and talented, severely emotionally disturbed, and mildly impaired on visual, auditory, or motor functions. The DAS has been documented for its utility describing LD subgroups. (Semrud-Clikeman & Teeter Ellison, 2009).

Kaufman Assessment Battery for Children (KABC II). The Kaufman Assessment Battery for Children was initially developed on neuropsychological theory as a measure of simultaneous and sequential processing. The KABC-2 was revised in 2004 and was designed to measure how a child processes information. Simultaneous processing is thought to be holistic and consistent with right hemisphere processing, whereas sequential processing is viewed as linear and analytic, which is a function of left-hemisphere processing (Semrud-Clikeman & Teeter Ellison, 2009). The battery provides a Mental Processing Index in addition to a Nonverbal Index for global scores. The global scales consist of the following: Sequential, Simultaneous, Planning, Learning, and Knowledge.

Stanford-Binet Intelligence Scales: Fifth Edition (SB5). The SB5 is designed to measure five basic constructs from CHC theory (Fluid Reasoning, Knowledge, Quantitative Reasoning, Visual-Spatial Processing, and Working Memory), using both verbal and nonverbal formats. The SB5 was standardized on 4,800 people aged from 2 to over 85 years, generally matching the demographic characteristics of the 2000 U.S. census (Hale & Fiorello, 2004). Reliability studies indicate that the Full Scale is highly reliable, with coefficients of .97 to .98 across all age groups. Individual subtests range from .84 to .89, although some age groups have lower subtest reliabilities (Hale & Fiorello, 2004).

Woodcock-Johnson Tests of Cognitive Ability-III (WJ-III COG). The WJ-III was developed by Woodcock and Johnson (1977), revised in 1989, and again in 2001. The WJ-III is based on the intellectual model of crystallized knowledge and fluid intelligence and is useful for measuring cognitive ability, scholastic aptitude, and achievement (Semrud-Clikeman & Teeter Ellison, 2009). The assessment consists of scales that measure attention, executive functioning, working memory, verbal ability, thinking ability and cognitive flexibility, in addition to measuring intelligence. The WJ-III offers a method of gathering benchmark measures of a variety of abilities, including auditory processing, memory and retrieval, and reasoning abilities. In addition, the WJ-III has strong psychometric properties (Semrud-Clikeman & Teeter Ellison, 2009).

Wechsler Intelligence Scale for Children – Fourth Edition (WISC-IV). The Wechsler Intelligence Scale for Children – Fourth Edition (WISC-IV), the latest version of the Wechsler scales, and the most commonly used cognitive assessment instrument in schools (Hale & Fiorello, 2004), is utilized for children 6 to 16 years old. The WISC-IV contains 15 subtests, which are divided into 10 core and 5 supplemental subtests. The core and supplemental subtests form four Composites: Verbal Comprehension, Perceptual Reasoning, Working Memory, and Processing Speed. The Verbal Comprehension Index (VCI) includes the Similarities, Vocabulary, and Comprehension (core) subtests and Information and Work Reasoning (supplemental) subtests. The Perceptual Reasoning Index (PRI) consists of the Block Design, Picture Concepts, and Matrix Reasoning (core) subtests and Picture Completion (supplemental) subtest. The Working Memory Index (WMI) comprises the Digit Span and Letter-Number Sequencing (core) subtests and Arithmetic (supplemental) subtest. The Processing Speed

Index (PSI) encompasses Coding and Symbol Search (core) and Cancellation (supplemental). The WISC-IV also provides seven Process scores that are designed to provide additional information about cognitive abilities (Sattler & Dumont, 2004). These scores are Block Design No Time Bonus (BDNTB), Digit Span Forward (DSF), Digit Span Backward (DSB), Longest Digit Span Forward (LDSF), Longest Digit Span Backward (LDSB), Cancellation Random (CAR), and Cancellation Structured (CAS).

With the exception of the Arithmetic subtest, which was standardized on 1,100 children, the WISC-IV was standardized on 2,200 children who were selected to represent children in the United States (Sattler & Dumont, 2004). The standardization group contained 11 age groups, with children ranging in age from 6 to 16 years. There were 100 boys and 100 girls in each age group, except for the Arithmetic standardization group (50 boys and 50 girls). In regard of race/ethnic membership, children were noted as Euro American, African American, Hispanic American, Asian American, or Other. The four geographical regions (Northeast, South, Midwest, and West) of the United States were sampled. Children were selected so that the composition of each age group matched as closely as possible to the proportions found in the March 2000 U.S. Census with regard to race/ethnicity, geographic region, and parental education (Sattler & Dumont, 2004).

The WISC-IV uses standard scores (M = 100, SD = 15) for the four Index scores and for the Full Scale IQ. Scaled scores (M = 10, SD = 3) are used for the 15 subtests. Scaled scores are also used for five of the seven Process scores (BDN, DSF, DSB, CAR, CAS), and raw scores are used for the other two Process scores (LDSF, LDSB). The Full Scale IQ is calculated by comparing the sum of the child's 10 core subtest scaled scores with the scores earned by a representative sample of the child's age group. After each subtest is scored, raw-score points are summed and then converted to scaled scores within the child's own age (in three-month intervals) through use of tables in the WISC-IV Administrative Manual. Additional tables in the manual are used to obtain the Index scores and Full Scale IQs based on the 10 core subtests. The WISC-IV has good reliability (Sattler & Dumont, 2004). Internal consistency reliability coefficients for the 11 age groups range from .91 to .95 ($M\ r_{xx}$ = .94) for Verbal Comprehension, from .91 to .93 ($M\ r_{xx}$ = .92) for Perceptual Reasoning, from .90 to .93 ($M\ r_{xx}$ = .92) for Working Memory, from .81 to .90 ($M\ r_{xx}$ = .88) for Processing Speed, and from .96 to .97 ($M\ r_{xx}$ = .97) for the Full Scale (Sattler & Dumont, 2004). The WISC-IV is a stable instrument with average test-retest coefficients of .93, .89, .89, .86, and .93 for the VCI, PRI, WMI, PSI, and FSIQ, respectively (Flanagan & Kaufman, 2009).

The term Verbal Comprehension describes a hypothesized verbal-related ability test, underlying the Composite for both item content (verbal) and mental process (comprehension). Verbal Comprehension measures verbal knowledge and understanding obtained through both informal and formal education and reflects the application of verbal skills to new situations. The term Perceptual Reasoning describes performance-related ability underlying the Composite for both item content (perceptual) and mental process (reasoning). Perceptual Reasoning measures the ability to interpret and organize visually perceived material and to generate and test hypotheses related to problem solutions. The term Working Memory describes a memory-related ability underlying the Composite. Working Memory measures immediate memory and the ability to sustain attention, concentrate, and exert mental control. Processing Speed describes a processing ability underlying the Composite. Processing Speed measures the ability to process visually perceived, nonverbal information quickly, with concentration and rapid eye-hand coordination being important components.

Contemporary Intellectual Assessment Theory

CHC Theory. Cattell-Horn-Carroll (CHC) theory is an amalgamation of two similar theories about the content and structure of human cognitive abilities (McGrew, Schrank, & Woodcock, 2007). The first of these two theories is Cattell-Horn's *Gf-Gc* theory and the second is Carroll's three-stratum theory. *Gf-Gc* received its original name because early versions of the theory proposed only two abilities: fluid intelligence (*Gf*) and crystallized intelligence (*Gc*). The three-stratum theory postulates the theory that most factors of interest can be classified as being at a certain stratum, and the total array of cognitive ability factors contains factors at three strata (Carroll, 2005). At the third, or highest stratum, is a general factor that is often referred to as *g*. The second stratum is composed of a small number of broad factors, which include fluid intelligence, crystallized intelligence, general memory and learning, broad visual perception, broad auditory perception, broad retrieval ability, broad cognitive speediness, and processing speed. At the first stratum, there are numerous first-order factors. Some scores indicate level of mastery, and others indicate the speed with which the individual performs tasks.

CHC taxonomy is the most comprehensive and empirically supported framework available for understanding the structure of human cognitive abilities (McGrew et al., 2007). Most new and revised individually administered tests of intelligence are either based on CHC theory or adhere to the theory. Although not based explicitly on CHC theory, the latest versions of the traditionally atheoretical Wechsler scales reference CHC theory in their manuals (Wechsler, 2003). The current version of the WISC draws on CHC theory in its organization and structure. The WISC-IV was designed to better incorporate theory (including CHC theory) and research into the classic scale. In particular, the developers of the WISC-IV sought to add measures of *Gf* to the revised instrument. The four-factor structure can be interpreted as reflecting *Gc* (Verbal Comprehension), a combination of *Gf* and *Gv* (Perceptual Reasoning), *Gsm* (Working Memory), and *Gs* (Processing Speed), from a CHC perspective (Keith & Reynolds, 2010).

Fluid intelligence (*Gf*) refers to mental operations that an individual uses when faced with a relatively novel task that cannot be performed automatically. Constructing and identifying concepts, recognizing relationships among patterns, making inferences, comprehending inferences, problem solving, extrapolating, and reorganizing or transforming information are examples of these mental operations **(**Flanagan & Kaufman, 2009). Inductive and deductive reasoning are considered to be the hallmark, narrow-ability indicators of *Gf*. The WISC-IV provides three distinct reasoning tests which examine *Gf*. These subtests include Matrix Reasoning, which involves the use of general sequential reasoning (i.e., deductive reasoning), and Picture Concepts and Word Reasoning subtests, which involve the use of inductive reasoning. The Matrix Reasoning subtest requires both General Sequential Reasoning (RG) and Induction (I), and Picture Concepts utilizes Induction and *Gc*-K0. General Sequential Reasoning suggests a capability to begin with stated rules, premises, or conditions, and to employ one or more steps to reach a solution to a novel problem. Induction places an emphasis on the ability to find the fundamental characteristic (e.g., rule, concept, process) that governs a problem.

The Math Problem Solving subtest on the WIAT taps into *Gf*, requiring the use of Quantitative Reasoning (RQ). The ability to inductively (I) and/or deductively (RG) reason with concepts involving mathematical relations and properties are the hallmarks of RQ. *Gf* is not directly assessed on the WJ III NU ACH; rather, it is assessed through the WJ III Tests of Cognitive Abilities.

Crystallized Intelligence (*Gc*) refers to the depth and breadth of a person's acquired knowledge and the effective application of this knowledge (Flanagan & Kaufman, 2009). This store of primarily verbal or language-based knowledge characterizes abilities that have been largely developed through the use and development of other abilities during educational and life experiences. Both declarative and procedural knowledge are components of *Gc*. Declarative knowledge is held in long-term memory (*Glr*) and is triggered when related information is in working memory (*Gsm*). Factual information, concepts, relationships, rules, and comprehension (especially when the content is verbal in nature) are examples of declarative knowledge. The process of reasoning with previously learned procedures in order to transform information is defined as procedural knowledge. The WISC-IV measures several different aspects of *Gc* (Flanagan & Kaufman, 2009). The WISC-IV Verbal Comprehension Index (VCI), which is composed of Vocabulary, Similarities, and Comprehension subtests, provides an assessment of several *Gc* narrow abilities. These abilities include Lexical Knowledge (VL), Language Development (LD), and General Information (K0). Lexical Knowledge refers to the level of vocabulary that can be understood in terms of correct word meanings, and Language Development is noted as the understanding of words, sentences, and paragraphs in spoken native language skills. Language Development does not require reading; rather, it is the general understanding of words, sentences, and paragraphs. General (verbal) Information is essentially the range of general knowledge. The WISC-IV Information (K0), Vocabulary (VL), Word Reasoning (VL, *Gf*-I), Comprehension (K0, LD), Similarities (LD, VL, *Gf*-I), Picture Concepts (K0), and Picture Completion (K0) subtests involve the use of several specific *Gc* narrow abilities. *Gc* is unique when compared with other broad abilities because it seems to be both a store of acquired knowledge (e.g., lexical knowledge) as well as a compilation of processing abilities (e.g., oral production and fluency). Although *Gc* is often theorized as an ability that is highly dependent upon learning experiences (particularly classroom experiences), it also encompasses a few narrow constructs that are more process oriented.

The WIAT provides measures of *Gc* on the Listening Comprehension (Receptive Vocabulary component) and Oral Expression. These two areas tap into (VL). The Listening Comprehension (Oral Discourse Comprehension) subtest requires the use of Listening Ability (LS), which is the ability to listen and understand the meaning of oral communications (spoken words, sentences, and paragraphs). In essence, LS is the ability to receive and understand spoken information. The Story Recall subtest on the WJ III NU ACH provides measures of Listening Ability and Meaningful Memory, and the Understanding Directions subtest investigates both Listening Ability and Working Memory. All of these subtests are on the standard battery.

Quantitative Knowledge (*Gq*) represents an individual's store of acquired, quantitative, declarative, and procedural knowledge. The *Gq* store of acquired knowledge is characterized by the ability to use quantitative information and manipulate numeric symbols (Flanagan & Kaufman, 2009). Although intelligence batteries measure some aspects of *Gq*, these tests typically do not measure *Gq* comprehensively. *Gq* abilities are traditionally assessed through achievement tests. The WISC-IV Arithmetic subtest measures Math Achievement. It is important to recognize that *Gq* and Quantitative Reasoning (RQ) differ and it is necessary to understand the difference between these two concepts. Overall, *Gq* symbolizes an individual's store of acquired mathematical knowledge, which includes the ability to complete mathematical calculations correctly. Quantitative Reasoning represents only the ability to reason inductively and deductively when solving quantitative problems. Quantitative Reasoning is a narrow ability that is typically found under *Gf*. However, because Quantitative Reasoning is dependent on the possession of basic mathematical concepts and knowledge, it appears to be as much a narrow ability under *Gq* as it is under *Gf* (Flanagan & Kaufman, 2009). Quantitative Reasoning is most apparent when a task requires general mathematical knowledge and mathematical skills. Although most achievement batteries measure specific mathematical skills and general mathematical knowledge, some batteries also require individuals to solve quantitative problems through inductive or deductive reasoning. Therefore, Quantitative Reasoning may best be conceptualized as a narrow ability that falls under both *Gf* and *Gq* broad abilities.

The Math Problem Solving subtest on the WIAT requires the use of Gq Math Knowledge (KM). In addition to KM, the Math Problem Solving subtest also requires Math Achievement (A3), as does the Numerical Operations, and Math Fluency subtests. The WJ III NU ACH Calculation (A3), Math Fluency (A3 and Number Facility), and

Applied Problems (A3, KM, and QR) subtests on the standard battery measures aspects of *Gq*. According to McGrew (2005), KM is the range of general knowledge about mathematics. This is the range only of general knowledge and not the performance of mathematical operations or the solving of math problems. Measured (tested) mathematics achievement is the quintessential feature of A3.

Short-Term Memory (*Gsm*) is the ability to hold information in immediate consciousness and then use it within a few seconds. Short-term memory has a limited capacity, because most individuals can retain only seven chunks of information (plus or minus two) in this system at one time (Flanagan & Kaufman, 2009). Information is usually retained for only a few seconds before it is lost. This is due to the limited amount of information that can be held in short-term memory. When engaged in a new task that requires an individual to use *Gsm* abilities to store new information, the previous information held in short-term memory is either lost or has to be stored in the acquired stores of knowledge (i.e., *Gc*, *Gq*, *Grw*) through the use of Long-Term Storage and Retrieval (*Glr*). In the CHC model, *Gsm* includes the narrow construct of working memory, which is considered to be a mechanism responsible for the temporary storage and processing of information. The phonological loop processes auditory-linguistic information. It is a temporary storage system for acoustic and speech-based information in working memory. The visuospatial sketchpad is the temporary buffer for visually processed information, which allows for the manipulation of visuospatial information in working memory (Miller, 2013). Most working memory models also include a hypothesized central executive system that coordinates and manages the activities and subsystems in working memory (Flanagan & Kaufman, 2009). Many cognitive batteries assess only one aspect of working memory and these batteries usually evaluate either the phonological loop or the visuospatial sketchpad, but not both. Although the validity of the Working Memory construct has been criticized (Carroll, 1993), it is included in current CHC theory. The WISC-IV Letter-Number Sequencing subtest is purported to measure the narrow ability of Working Memory (WM) and the WISC-IV Digit Span subtest is theorized to measure Memory Span (MS) and Working Memory (Digit Span Backward). Memory Span is noted as the ability to attend to and immediately recall temporally ordered elements in the correct order after a single presentation. The Working Memory narrow ability is defined in the context of the ability to store and perform a set of cognitive operations on information that requires divided attention and the management of the limited capacity of short-term memory. The Oral Expression subtest of the WIAT requires the use of MS as well. The WJ III NU ACH does not explicitly measure *Gsm*, because this is examined primarily through subtests on the WJ III Tests of Cognitive Abilities.

Visual Processing (*Gv*) is the ability to generate, perceive, analyze, synthesize, store, retrieve, manipulate, transform, and think with visual patterns and stimuli. These abilities are measured by tasks that require the perception and manipulation of visual shapes and forms, usually of a figural or geometric nature (Flanagan & Kaufman, 2009). Students with strengths in *Gv* have the ability to mentally reverse and rotate objects effectively, interpret how objects change as they move through space, perceive and manipulate spatial configurations, and maintain spatial orientations. The WISC-IV Block Design and Picture Completion subtests provide measures of *Gv*. The Block Design subtest measures the *Gv* narrow ability of Spatial Relations (SR) and Visualization (Vz), and the Picture Completion subtest primarily examines Flexibility of Closure (CF) and *Gc*-K0. Spatial Relations tap into the ability to perceive and manipulate relatively simple visual patterns quickly or to maintain orientation with respect to objects in space. Visualization requires the capability to mentally manipulate objects or visual patterns mentally and to see how they would appear under altered conditions. Flexibility of Closure investigates the ability to find and identify a visual figure or pattern embedded within a complex visual array, when knowing what the pattern is in advance. Although visual processing skills may be required on some portions of the WIAT, it does not directly measures *Gv*.

Auditory Processing (*Ga*) abilities are viewed as cognitive abilities that depend on sound as input and on hearing. These capabilities reflect the degree to which the person can cognitively control the perception of auditory inputs. Auditory Processing is the ability to perceive, analyze, and synthesize patters among auditory stimuli and discriminate subtle nuances in patterns of sound and speech when presented under distorted conditions (Flanagan & Kaufman, 2009). Although *Ga* abilities do not necessarily need the comprehension of language (*Gc*), they may be important in language skills development. Auditory Processing includes phonological awareness and processing. Consequently, tests that measure these abilities are typically found on achievement batteries, such as the WIAT Early Reading Skills composite. Early reading skills require Phonetic Coding (PC). In CHC theory, the Phonetic Coding narrow ability is divided into analysis (PC:A) and synthesis (PC:S) abilities. Analysis and synthesis are defined as the ability to segment larger units of speech into smaller units and the ability to blend smaller units of speech to form larger units. *Ga* is measured through the extended battery on the WJ III NU ACH (Word Attack, Spelling of Sounds, and Sound Awareness) and is assessed on the WJ III COG standard battery.

Long-Term Storage and Retrieval (*Glr*) is the ability to store information and retrieve new or previously acquired information fluently (e.g., concepts, ideas, items, names) from long-term memory (Flanagan & Kaufman, 2009). It is important not to confuse *Glr* with *Gc*, *Gq*, and *Grw*. *Gc*, *Gq*, and *Grw* represent what is stored in long-term memory, but *Glr* is the efficiency by which this information is initially stored and later retrieved from long-term memory. Different processes are involved in *Glr* and *Gsm*. The time lapse between the initial task performance and the recall of information related to that task is not critically important in defining *Glr*. The presence of an intervening task that engages short-term memory before the attempted recall of the stored information is more important. Although *Glr* is measured directly by several major intelligence batteries, the WISC-IV does not directly assess *Glr*.

The WIAT provides two subtests with measures of *Glr*. The WIAT Oral Expression (Oral Discourse component) requires the use of Association Fluency (FA), which is a highly specific ability to rapidly produce a series of words or phrases associated in meaning, when given a word or concept with a restricted area of meaning. The quality rather than quantity of production is emphasized in FA. The Listening Comprehension subtest taps into Meaningful Memory (MM). The use of MM is necessary in order to retain and recall information when there is a meaningful relationship between the bits of information; the information includes a meaningful story, or the information is related to existing contents of memory. The Story Recall – Delayed subtest on the WJ III NU ACH measures aspects *Glr*.

Processing Speed (*Gs*) is the ability to fluently and automatically perform cognitive tasks, especially when under pressure to maintain focused attention and concentration (Flanagan & Kaufman, 2009). It is typically assessed through fixed-interval, timed tasks that require little complex thinking or mental processing. A fundamental construct in information-processing models is the notion of limited processing resources. This is essentially the limited capacities of short-term or working memory. The speed of processing is critical due to the fact that it determines how rapidly limited resources can be distributed to other cognitive tasks. The WISC-IV provides three *Gs* tasks (Coding, Symbol Search, and Cancellation). Symbol Search and Cancellation measure the narrow ability of Perceptual Speed (P) and all three Processing Speed Index subtests measure Rate-of-Test-Taking (R9). Perceptual Speed is the ability to search for and compare known visual symbols or patterns presented side by side or separated in a visual field. Rate-of-Test-Taking is defined as the ability to rapidly perform tests which are relatively easy or that require very simple decisions.

All of the Math Fluency (Math Fluency – Addition, Math Fluency – Subtraction, Math Fluency – Multiplication) subtests provide measures of *Gs* through the narrow ability of Number Facility (N). Number Facility is the ability to rapidly perform basic arithmetic (i.e., addition, subtraction, multiplication, division) rapidly and manipulate numbers quickly and accurately. It does not involve understanding or organizing mathematical problems and is not a major component of mathematical/quantitative reasoning or higher level mathematical skills (McGrew, 2005). *Gs* is assessed on the WJ III Cog as part of the standard battery.

Reading/writing (*Grw*) is a person's wealth (depth and breadth) of declarative and procedural reading and writing skills and knowledge. *Grw* includes both basic skills (e.g., reading and spelling of single words) and the ability to read and write complex connected discourse(e.g., reading comprehension and the ability to write a story). The WIAT Word Reading and Pseudoword Decoding subtest and WJ III NU ACH Letter-Word Identification provide measures of Reading Decoding (RD), which is essentially the ability to recognize and decode words or pseudowords in reading, using a number of subabilities (e.g., grapheme encoding, phonemic contrasts, etc.). The narrow ability of Reading Comprehension (RC), which assesses an ability to attain meaning (comprehend and understand) connected discourse during reading (McGrew, 2005) is measured by the WIAT Reading Comprehension and WJ III NU ACH subtests and Verbal (printed) Language Comprehension (V) is measured through the Early Reading Skills (items requiring matching words with pictures) subtest. This narrow ability evaluates general development, or the understanding of words, sentences, and paragraphs in native language. It does not involve writing, listening to, or understanding spoken information. WIAT Spelling and Alphabet Writing Fluency, as well as WJ III NU ACH Spelling, subtests measure Spelling Ability (SG), which is the ability to form words with the correct letters in accepted order. The WIAT Alphabet Writing Fluency and WJ III NU ACH Writing Fluency also provide a measure of Writing Speed (WS). This narrow ability is also listed under *Gs* due to the processing component. A student's Writing Ability (WA) is assessed through WIAT Sentence Composition and Essay Composition and WJ III NU ACH Writing Fluency and Writing Samples. Writing ability is necessary in order to communicate information and ideas in written form so that others can understand (with clarity of thought, organization, and good sentence structure). The Sentence and Essay Composition subtests also provide a measure of English Usage Knowledge (EU). These are the knowledge of the mechanics of written and spoken English-language discourse. Last, Reading Speed (fluency) (RS) is evaluated through Word Reading (supplemental score), Pseudoword Decoding (supplemental score), and Oral Reading Fluency on the WIAT and Reading Fluency on the WJ III NU ACH. Reading speed (fluency) is a measure of the students' ability to read silently and to comprehend connected text rapidly and automatically. Reading speed (fluency) is also listed under *Gs* due to the processing speed demands (McGrew, 2005).

Chapter 3

Method

Overview

The current study utilized the Concordance-Discordance LD identification model (C-DM) developed by Hale and colleagues (Hale & Fiorello, 2004; Hale et al., 2003; Hale et al., 2008). Cognitive strengths and weakness and the relationships with specific academic areas were examined within the criteria of C-DM to determine whether or not the students in the archival sample of previously identified students meet criteria for SLD. For the purposes of this study, the WISC-IV was the only test used for examining the cognitive strength and weakness. The WJ III ACH, WJ III ACH NU, WIAT-II, and WIAT III were used to assess specific academic areas.

According to the Concordance-Discordance Model, children with SLD demonstrate cognitive discordance, cognitive-academic discordance, and cognitive-academic concordance. Cognitive discordance was identified as a significant difference between the highest and lowest WISC-IV factor scores. Cognitive-academic discordance was noted by a significant difference between the highest WISC-IV factor score and the lowest achievement subtest score. Last, cognitive-academic concordance was determined when no significant difference between the lowest WISC-IV factor score and achievement subtest score was found.

Participants

The participant data were drawn from a sample of 244 school-aged children who had been diagnosed with specific learning disabilities in the school setting. Student files were reviewed and 63 students were eliminated because they were classified, based upon functional performance rather than upon meeting ability-achievement discrepancy criteria. Another 4 students were omitted because cognitive measures were obtained through the WJ-III Cog and achievement measures were assessed through the K-TEA. Two students were eliminated from the sample because they did not have WISC-IV subtest scores and another 2 were removed because the evaluations were not concurrent. The final sample of 173 participants ranged in age from 6 to 16. Males composed 69.4% of the sample and females composed 30.6% of the sample. Student grade ranged from Kindergarten through eleventh grade. Please refer to Table 1 and 2 for additional demographic information.

Table 1

Descriptive Statistics of Student Sample

	Mean	Standard Deviation	Range
Age	10.20	2.45	6-16
Grade	4.62	2.49	K-11

Table 2

Demographic Characteristics of Participants (N = 173)

Characteristic	*n*	%
Gender		
Male	120	69.4
Female	53	30.6
Age		
6	6	3.5
7	18	10.4
8	27	15.6
9	21	12.1
10	28	16.2
11	26	15.0
12	11	6.4
13	20	11.6
14	7	4.0
15	3	1.7
16	6	3.5
English Language Arts Placement		
Self-Contained	2	1.2
Pullout Resource	57	32.9
In-Class Resource	50	28.9
Mainstream	7	4.0
Mathematics Placement		
Pullout Resource	57	32.9
In-Class Resource	42	24.3
Mainstream	17	9.8

(cont. on next page)

Table 2 (continued)

Characteristic	*n*	%
School		
Public	116	67.1
Nonpublic	57	32.9
Eligibility Method		
C-DM	97	56.1
AAD	76	43.9
Created C-DM Factor		
Yes	67	38.7
No	106	61.3

Inclusion/Exclusion Criteria

The data collected consisted of a convenience sample of students through special education support programs. All data used were archival and anonymous. Data were limited to students between the ages of 6-16 in order to remain consistent with the age range of the WISC-IV. Exclusion criteria included student files that did not contain current WISC-IV and current achievement testing results in the areas of reading, mathematics, and/or written language completed concurrently in the same evaluation. In addition, data were not accepted if the file did not have full WISC-IV subtest scaled scores and all four index scores.

Due to changes in the way in which SLD is identified, particularly through the implementation of a "third method" approach for SLD identification, this study utilized

Concordance-Discordance model (C-DM) for SLD identification. This model was used to determine whether the students in the archival sample met criteria for the presence of a specific learning disability by examining cognitive strengths and weaknesses and the relationships with specific academic areas.

Recruitment

The archival data were drawn from participating school districts in Southern New Jersey and representative of metropolitan, suburban, and rural areas. Data were collected from both public and nonpublic schools. Detailed information regarding the socioeconomic status of the selected children and students in the archival data set was not made available, although most data were drawn from a homogeneous, middle class population.

Measures and Materials

The first measure utilized was the WISC-IV standard battery, which is considered a reliable and valid measure of individual cognitive functioning according to Wechsler (2003). The WISC-IV is internally consistent with reliability coefficients of the subtests ranging from .79 to .90, and reliability coefficients for the composite scores ranging from .88 to .97. The WISC-IV is considered reliable for children with learning disabilities and is considered to have adequate stability over time (Wechsler, 2003). The WISC-IV standard battery is composed of ten core subtests (Block Design, Similarities, Digit Span, Picture Concepts, Coding, Vocabulary, Letter Number Sequencing, Matrix Reasoning, Comprehension, and Symbol Search). Four index scores (Verbal Comprehension, Perceptual Reasoning, Working Memory, and Processing Speed) and a Full Scale Intelligence Quotient (FSIQ) are derived from these subtests. In addition, subtest process scores can be computed to provide greater in-depth information regarding a student's performance.

Achievement scores were examined in the areas of reading, math, and written language of the archival data sample. Achievement scores were derived from nationally standardized, individually administered instruments and included either the Wechsler Individual Achievement Test, Second Edition (WIAT-II; Wechsler, 2001), the Wechsler Individual Achievement Test, Third Edition (WIAT-III; Wechsler, 2009), the Woodcock Johnson Tests of Achievement, Third Edition (WJ-III; Woodcock, McGrew, & Flanagan, 2001), and the Woodcock Johnson Test of Achievement, Third Edition Normative Update (WJ III NU ACH; McGrew, Shrunk, Woodcock, 2007). All of these instruments have good reliability and validity and have been used extensively in evaluations for SLD. The cognitive and achievement scores were part either of initial evaluations or re-evaluations for the identification of a specific learning disability conducted by the respective school psychologists and/or learning disabilities teacher-consultant and were included in the data file.

Procedure

Archival records of students previously identified with a specific learning disability in the school setting were utilized for the current study. Learning Disabilities Teacher-Consultants (LDT-C) and School Psychologists who are state and/or nationally certified were asked to volunteer data for this study. Individual student records were reviewed by the respective school psychologists or learning consultants to determine if WISC-IV subtest scaled scores and four factor indices are included. In addition, academic achievement standard scores were documented for all areas across available reading, math, and/or written language domains, but cases were not excluded with missing achievement domains. Last, SLD subtype was gathered from the sample, based upon discrepancies in the areas of reading, writing, and/or mathematics. The data was entered into a document designated *Student Data Collection Worksheet* (see Appendix A) by the LDT-C and/or school psychologist volunteers and were assigned a participant identification code number. Student age, gender, grade level and support services for English/Language Arts and Mathematics (e.g., mainstream, in-class resource, pullout replacement resource, self-contained) were included; however, student name and other confidential information was not obtained or released to the investigator. Concordance and discordance was established for the sample and students were identified as eligible for services under the Concordance-Discordance Model. In addition, students were assigned an SLD subtype, based upon the area(s) of disability through the ability-achievement discrepancy model and the Concordance-Discordance model. Table 3 reflects the frequency counts of SLD subtypes, which were identified as Reading SLD, Math SLD, Written Expression SLD, Mixed Reading/Math SLD, Mixed Reading/Written Expression SLD, Mixed Math/Written Expression SLD, and Mixed Reading/Math/Written Expression SLD. The AAD group had an Oral Expression SLD and Mixed Oral Expression/Listening Comprehension SLD subtype. The data were then subjected to several statistical analyses to determine if students who were previously determined eligible for special education services under the classification specific learning disability through the Ability-Achievement Discrepancy model would also be identified through the implementation of the Concordance-Discordance model. Differences between SLD area and identification method were examined. In addition, statistical analysis was run to determine if there were differences between the identification method and the level of intensive supports provided through educational programming. The database of participant data was transferred to the SPSS statistics computer package in order to run the statistical analyses.

Table 3

Specific Learning Disability Subtypes (N = 173)

Characteristic	*n*	%
District SLD Subtype		
Reading	53	30.6
Math	32	18.5
Written Expression	13	7.5
Mixed Reading/Math	16	9.2
Mixed Reading/Written Expression	27	15.6
Mixed Math/Written Expression	13	7.5
Mixed Reading/Math/Written Expression	14	8.1
Listening Comprehension	2	1.2
Oral Expression	2	1.2
Mixed Listening Comprehension and Oral Expression	1	0.6
C-DM SLD Subtype		
No C-DM Classification	76	43.9
Reading	21	12.1
Math	12	6.9
Written Expression	3	1.7
Mixed Reading/Math	6	3.5
Mixed Reading/Written Expression	20	11.6
Mixed Math/Written Expression	3	1.7
Mixed Reading/Math/Written Expression	32	18.5

Analyses

Frequency counts and descriptive data were computed. Correlations were conducted to investigate relationships between cognitive and achievement measures for C-DM and AAD eligible students. A chi-square was conducted, investigating the differences the between classification method and student academic placement. Independent samples *t*-test were conducted to examine differences in WISC-IV index scores and achievement measures between students found eligible through C-DM and AAD. A one-way analysis of variance (ANOVA) was conducted to determine differences between SLD subtypes for students identified through the AAD model and C-DM. Post hoc testing was conducted in order to test further for significance.

Chapter 4

Results

Descriptive Statistics

Table 4 reports the descriptive statistics for the WISC-IV variables across the entire sample of students with SLD classification through the C-DM and AAD models. Students eligible through C-DM recorded higher WISC-IV index scores, as well as higher subtest scores than students eligible through AAD. Letter-Number Sequencing and Symbol Search were the only two subtests that yielded higher subtest scores for those identified through AAD.

Table 4

Descriptive Statistics of WISC-IV Composite and Subscales (N = 173)

WISC-IV Score	C-DM		AAD		Total	
	M	SD	M	SD	M	SD
	Index Scores					
Full Scale IQ	98.02	10.01	92.88	11.13	95.76	10.83
Verbal Comprehension	100.28	10.09	95.89	9.79	98.35	10.17
Perceptual Reasoning	101.49	12.70	94.21	11.58	98.29	12.72
Working Memory	94.36	11.80	92.61	10.41	93.59	11.21
Processing Speed	94.48	13.77	93.88	12.98	94.22	13.39
	Subtest Scores					
Similarities	10.20	2.25	9.42	2.02	9.86	2.18
Vocabulary	9.90	2.22	8.97	2.35	9.49	2.31
Comprehension	10.46	2.30	9.78	2.23	10.16	2.29
Block Design	10.00	2.69	8.45	2.47	9.32	2.70
Picture Concepts	10.51	2.55	9.83	2.61	10.21	2.59
Matrix Reasoning	10.29	2.70	8.87	2.11	9.66	2.55
Digit Span	8.96	2.39	8.29	2.38	8.66	2.40
L-N S	9.28	2.58	9.33	2.43	9.30	2.51
Coding	8.59	2.85	8.24	2.68	8.43	2.77
Symbol Search	9.39	2.63	9.61	2.60	9.49	2.61

Note. L-N S = Letter-Number Sequencing

The achievement means depicted in Table 5 show mean scores across all areas of achievement in the sample for student with SLD. Students eligible through C-DM tended to score lower on the achievement measures than those classified through AAD. Exceptions were noted in the areas of Math Problem Solving, Oral Expression, and Listening Comprehension, with C-DM classified students demonstrating slightly higher achievement scores. A majority of the academic achievement scores for students identified through C-DM fell in the low average range, whereas students identified through AAD were primarily within the average range.

Table 5

Descriptive Statistics of Academic Achievement Composite and Subscales

Academic Domain	C-DM			AAD			Total		
	n	*M*	*SD*	*n*	*M*	*SD*	*n*	*M*	*SD*
Reading Composite	30	86.73	14.50	20	92.60	10.44	50	89.08	13.23
Reading Comp	94	89.35	12.11	75	93.01	8.60	169	90.98	10.82
Reading Fluency	61	88.89	9.54	42	92.71	11.09	103	90.45	10.32
Word Reading	90	87.46	11.60	72	93.83	9.72	162	90.29	11.23
Decoding	68	86.00	14.03	61	91.61	15.88	129	88.65	15.13
Math Composite	96	89.86	12.41	72	90.44	11.76	168	90.11	12.11
Math Calculation	95	91.18	12.68	76	92.62	12.75	171	91.82	12.70
Math PS	93	93.05	11.59	75	92.85	11.32	168	92.96	11.44
Oral Expression	49	95.94	13.62	39	95.74	11.38	88	95.85	12.60
Listening Comp	55	99.00	12.27	51	97.45	11.53	106	98.25	11.89
Broad WE	83	86.43	10.73	65	92.23	8.58	148	88.98	10.22
Written Expression	89	90.70	11.76	70	94.36	10.54	159	92.31	11.35
Spelling	93	86.02	11.43	74	93.92	8.62	167	89.52	10.98

Note. Reading Comp = Reading Comprehension; Math PS = Math Problem Solving; Listening Comp = Listening Comprehension; Broad WE = Broad Written Expression

Relationships between Cognitive and Academic Variables for C-DM

Pearson bivariate correlations were computed to determine any significant relationships between measures of cognitive functioning and academic achievement for students eligible through C-DM. Full Scale IQ was positively correlated with Verbal Comprehension, Perceptual Reasoning, Working Memory, and Processing Speed. Large effect sizes were noted between FSIQ and index scores. In addition, FSIQ was significantly correlated with Reading Comprehension, which demonstrates that the stronger the level of cognitive functioning, the higher the level of Reading Comprehension. Verbal Comprehension was significantly correlated with Working Memory, Reading Composite, Reading Comprehension, and Word Reading. A moderate effect size was noted in these areas. Working Memory was positively correlated with Reading Comprehension. No significant correlations were noted between Perceptual Reasoning or Processing Speed and achievement in reading. All achievement areas within the reading domain were positively correlated, with the exception of Reading Comprehension and Decoding. Examination of these relationships as depicted in Table 6 revealed multiple, significant correlations.

Full Scale IQ was positively correlated with the Math Composite, Math Calculation, and Math Problem Solving. Interestingly, Verbal Comprehension was positively correlated with all areas of math achievement. Math Composite, Math Calculation, and Math Problem Solving were positively correlated with Perceptual Reasoning. Working Memory was significantly correlated with math achievement, although small effect sizes were noted. Processing Speed and Math Calculation was also significantly correlated. Examination of these relationships as depicted in Table 7 revealed multiple, significant correlations.

Table 6

Correlations Between WISC-IV and Reading for C-DM

	1	2	3	4	5	6	7	8	9	10
1	--									
2	.60***	--								
3	.68***	.17	--							
4	.68***	.30**	.23*	--						
5	.59***	.04	.21*	.35***	--					
6	.18	.31**	-.03	.18	-.01	--				
7	.33***	.45***	.10	.22*	.06	.69***	--			
8	.09	.16	-.10	.11	.13	.71***	.39**	--		
9	.13	.32**	-.14	.18	-.03	.91***	.51***	.54***	--	
10	-.03	.03	-.02	.02	-.11	.72***	.18	.48**	.65***	--

Note. 1 = Full Scale IQ; 2 = Verbal Comprehension Index; 3 = Perceptual Reasoning Index; 4 = Working Memory Index; 5 = Processing Speed Index; 6 = Reading Composite; 7 = Reading Comprehension; 8 = Reading Fluency; 9 = Word Reading; 10 = Decoding

*p < .05, ** p< .01, *** p < .001

Table 7

Correlations Between WISC-IV and Math for C-DM

	1	2	3	4	5	6	7	8
1	--							
2	.60***	--						
3	.68***	.17	--					
4	.68***	.30**	.23*	--				
5	.59***	.04	.21*	.35***	--			
6	.50***	.41***	.42***	.22*	.19	--		
7	.49***	.39***	.38***	.22*	.23*	.91***	--	
8	.45***	.41***	.41***	.25*	.08	.91***	.70***	--

Note. 1 = Full Scale IQ; 2 = Verbal Comprehension Index; 3 = Perceptual Reasoning Index; 4 = Working Memory Index; 5 = Processing Speed Index; 6 = Math Composite; 7 = Math Calculation; 8 = Math Problem Solving

*p < .05, ** p< .01, *** p < .001

Relationships between Cognitive and Academic Variables for AAD

Pearson bivariate correlations were computed to determine if any significant relationships between measures of cognitive functioning and academic achievement for students eligible through the AAD model. Full Scale IQ was positively correlated with Verbal Comprehension, Perceptual Reasoning, Working Memory, and Processing Speed. Large effect sizes were noted between FSIQ and all index scores. In addition, FSIQ was significantly, positively correlated with all measures of reading achievement, with the exception of Decoding. Verbal Comprehension was significantly correlated with Perceptual Reasoning, Working Memory, Processing Speed, and all measures of reading achievement. Perceptual Reasoning was positively correlated with Working Memory, Processing Speed, Reading Composite, and Word Reading. Working Memory was positively correlated with Processing Speed, Reading Composite, and Word Reading. Processing Speed and Word Reading were also positively correlated, although a small effect size was noted. All achievement areas within the reading domain were positively correlated with one another. Examination of these relationships as represented in Table 8 revealed multiple, significant correlations.

Full Scale IQ was positively correlated with the Math Composite, Math Calculation, and Math Problem Solving. Verbal Comprehension was positively correlated with all areas of math achievement, ranging from medium to large effect sizes. A significant, positive relationship was found between Math Composite, Math Calculation, and Math Problem Solving and Perceptual Reasoning. Working Memory and Processing Speed was significantly correlated with math achievement, with medium effect sizes noted. All areas of math achievement were significantly related, with large effect sizes reported. Examination of these relationships as described in Table 9 revealed multiple, significant correlations.

Table 8

Correlations Between WISC-IV and Reading for AAD

	1	2	3	4	5	6	7	8	9	10
1	--									
2	.78***	--								
3	.83***	.47***	--							
4	.77***	.52***	.58***	--						
5	.69***	.36**	.44***	.41***	--					
6	.44***	.51***	.28*	.33**	.19	--				
7	.34**	.47***	.22	.22	.14	.72***	--			
8	.38*	.49**	.21	.24	.30	.79***	.44**	--		
9	.44***	.37**	.33**	.38**	.24*	.85***	.48***	.51**	--	
10	.22	.27*	.11	.10	.12	.58***	.29*	.71***	.45***	--

Note. 1 = Full Scale IQ; 2 = Verbal Comprehension Index; 3 = Perceptual Reasoning Index; 4 = Working Memory Index; 5 = Processing Speed Index; 6 = Reading Composite; 7 = Reading Comprehension; 8 = Reading Fluency; 9 = Word Reading; 10 = Decoding

*p < .05, ** p< .01, *** p < .001

Table 9

Correlations Between WISC-IV and Math for AAD

	1	2	3	4	5	6	7	8
1	--							
2	.78***	--						
3	.83***	.47***	--					
4	.77***	.52***	.58***	--				
5	.69***	.36**	.44***	.41***	--			
6	.59***	.51***	.45***	.42**	.40**	--		
7	.48**	.38**	.33**	.39***	.40***	.87***	--	
8	.49*	.37**	.41***	.36**	.34**	.84***	.53***	--

Note. 1 = Full Scale IQ; 2 = Verbal Comprehension Index; 3 = Perceptual Reasoning Index; 4 = Working Memory Index; 5 = Processing Speed Index; 6 = Reading Composite; 7 = Reading Comprehension; 8 = Reading Fluency; 9 = Word Reading; 10 = Decoding

*p < .05, ** p< .01, *** p < .001

Relationships between Cognitive Functioning and C-DM Subtype

Pearson bivariate correlations were computed to determine if any significant relationships between measures of cognitive functioning were found based upon C-DM subtype. As noted in Table 10, Full Scale IQ was significantly correlated with Verbal Comprehension, Perceptual Reasoning, Working Memory, and Processing Speed for students with the Reading SLD subtype. A relationship between Verbal Comprehension and Working Memory was indicated, as was a positive relationship between Perceptual Reasoning and Processing Speed. Significant correlations were noted between Full Scale IQ and Perceptual Reasoning, Working Memory, and Processing Speed for the Math SLD subtype, which is reflected in Table 11. No significant relationship was found between Full Scale IQ and Verbal Comprehension for this SLD subtype. A positive correlation was noted between Perceptual Reasoning, Working Memory, and Processing Speed. Table 12 illustrates the relationships between cognitive functioning for the Written Expression SLD subtype, with the only significant correlation between Full Scale IQ and Processing Speed, which had a small effect size.

Correlations of the Mixed SLD subtypes are depicted in Tables 13, 14, 15, and 16. Full Scale IQ was significantly correlated with Perceptual Reasoning for the Mixed Reading/Math SLD subtype; however, no other significant relationships were noted. A significant relationship between Full Scale IQ and Verbal Comprehension, Perceptual Reasoning, Working Memory, and Processing Speed was found for the Mixed Reading/Writing SLD subtype. Significant correlations were not obtained between the WISC-IV index scores. The Mixed Math/Writing SLD subtype indicated a significant negative correlation between Perceptual Reasoning and Processing Speed. No other correlations were reported for this SLD subtype. Full Scale IQ was significantly correlated with Verbal Comprehension, Perceptual Reasoning, Working Memory, and Processing Speed for the Mixed Reading/Math/Writing SLD subtype. A Positive relationship between Verbal Comprehension and Working Memory was obtained, as was a positive relationship between Working Memory and Processing Speed.

Last, Table 17 depicts the relationships between WISC-IV Full Scale IQ and index scores for students who were not found eligible for special education services through C-DM. Full Scale IQ and all index scores were significantly correlated with one another. The relationship was positive and the effect sizes ranged from medium to large. As Full Scale IQ increased, Verbal Comprehension, Perceptual Reasoning, Working Memory, and Processing Speed increased.

Table 10

Correlations Between WISC-IV and C-DM Reading SLD Subtype (N = 21)

	FSIQ	VCI	PRI	WMI	PSI
FSIQ	--				
VCI	.75***	--			
PRI	.61**	.19	--		
WMI	.83***	.55**	.36	--	
PSI	.75***	.41	.47*	.42	--

Note. FSIQ = Full Scale IQ; VCI = Verbal Comprehension Index; PRI = Perceptual Reasoning Index; WMI = Working Memory Index; PSI = Processing Speed Index

*p < .05, ** p< .01, *** p < .001

Table 11

Correlations Between WISC-IV and C-DM Math SLD Subtype (N = 12)

	FSIQ	VCI	PRI	WMI	PSI
FSIQ	--				
VCI	.32	--			
PRI	.90***	.97	--		
WMI	.80**	.15	.66*	--	
PSI	.75**	-.14	.64*	.51	--

Note. FSIQ = Full Scale IQ; VCI = Verbal Comprehension Index; PRI = Perceptual Reasoning Index; WMI = Working Memory Index; PSI = Processing Speed Index

*p < .05, ** p< .01, *** p < .001

Table 12

Correlations Between WISC-IV and C-DM Written Expression SLD Subtype (N = 3)

	FSIQ	VCI	PRI	WMI	PSI
FSIQ	--				
VCI	.71	--			
PRI	.97	.51	--		
WMI	.10	.65	.99	--	
PSI	.10*	.76	.95	.99	--

Note. FSIQ = Full Scale IQ; VCI = Verbal Comprehension Index; PRI = Perceptual Reasoning Index; WMI = Working Memory Index; PSI = Processing Speed Index

*p < .05, ** p< .01, *** p < .001

Table 13

Correlations Between WISC-IV and C-DM Mixed Reading/Math SLD Subtype (N = 6)

	FSIQ	VCI	PRI	WMI	PSI
FSIQ	--				
VCI	.31	--			
PRI	.91*	.27	--		
WMI	.58	-.54	.48	--	
PSI	-.34	-.52	-.64	.24	--

Note. FSIQ = Full Scale IQ; VCI = Verbal Comprehension Index; PRI = Perceptual Reasoning Index; WMI = Working Memory Index; PSI = Processing Speed Index

*p < .05, ** p< .01, *** p < .001

Table 14

Correlations Between WISC-IV and C-DM Mixed Reading/Writing SLD Subtype (N = 20)

	FSIQ	VCI	PRI	WMI	PSI
FSIQ	--				
VCI	.58**	--			
PRI	.69***	.39	--		
WMI	.62**	.19	.18	--	
PSI	.59**	-.03	.15	.23	--

Note. FSIQ = Full Scale IQ; VCI = Verbal Comprehension Index; PRI = Perceptual Reasoning Index; WMI = Working Memory Index; PSI = Processing Speed Index

*p < .05, ** p< .01, *** p < .001

Table 15

Correlations Between WISC-IV and C-DM Mixed Math/Writing SLD Subtype (N = 3)

	FSIQ	VCI	PRI	WMI	PSI
FSIQ	--				
VCI	.05	--			
PRI	-1.0	.04	--		
WMI	.48	-.85	-.56	--	
PSI	.99	-.08	-1.0*	.60	--

Note. FSIQ = Full Scale IQ; VCI = Verbal Comprehension Index; PRI = Perceptual Reasoning Index; WMI = Working Memory Index; PSI = Processing Speed Index

*p < .05, ** p< .01, *** p < .001

Table 16

Correlations Between WISC-IV and C-DM Mixed Reading/Math/Writing SLD Subtype (N = 32)

	FSIQ	VCI	PRI	WMI	PSI
FSIQ	--				
VCI	.67***	--			
PRI	.51**	-.05	--		
WMI	.72***	.42*	.19	--	
PSI	.63***	.05	.30	.37*	--

Note. FSIQ = Full Scale IQ; VCI = Verbal Comprehension Index; PRI = Perceptual Reasoning Index; WMI = Working Memory Index; PSI = Processing Speed Index

*p < .05, ** p< .01, *** p < .001

Table 17

Correlations Between WISC-IV and No C-DM Classification (N = 76)

	FSIQ	VCI	PRI	WMI	PSI
FSIQ	--				
VCI	.78***	--			
PRI	.83***	.47***	--		
WMI	.77***	.52***	.58***	--	
PSI	.69***	.36***	.44***	.41***	--

Note. FSIQ = Full Scale IQ; VCI = Verbal Comprehension Index; PRI = Perceptual Reasoning Index; WMI = Working Memory Index; PSI = Processing Speed Index

*p < .05, ** p< .01, *** p < .001

Relationships between Cognitive Functioning and Academic Placement

Pearson bivariate correlations were computed to determine if any significant relationships between measures of cognitive functioning were found based upon English Language Arts and Mathematics placement. As noted in Table 18, Full Scale IQ was significantly correlated with Verbal Comprehension, Perceptual Reasoning, Working Memory, and Processing Speed for classified students both in a pullout replacement resource center and an in-class resource programs. Interestingly, only Perceptual Reasoning and Working Memory were significantly correlated with Full Scale IQ for students that were in a mainstream program. Upon further analysis of WISC-IV index scores within each placement, Verbal Comprehension and Perceptual Reasoning were positively correlated for students in an in-class resource program. In addition, Working Memory was related to Verbal Comprehension, Perceptual Reasoning, and Processing Speed. No additional relationships with index scores were noted for students placed in a pullout replacement resource center program or mainstream setting.

As depicted in Table 19, Full Scale IQ was significantly correlated with Verbal Comprehension, Perceptual Reasoning, Working Memory, and Processing Speed for classified students both in pullout replacement resource center and an in-class resource programs for Math. Verbal Comprehension, Perceptual Reasoning and Working Memory were significantly correlated with Full Scale IQ for students that were in a mainstream program without any additional supports. Upon further analysis of WISC-IV index scores within each placement, Processing Speed was related to both Perceptual Reasoning and Working Memory for students in a pullout resource program. Students in an in-class resource program demonstrated a significant relationship of Working Memory with both

Verbal Comprehension and Perceptual Reasoning. No additional relationships with index scores were noted for students placed in a mainstream setting.

Table 18

Correlation Between WISC-IV and English Language Arts Placement

		FSIQ	VCI	PRI	WMI	PSI
Resource						
	FSIQ	--				
	VCI	.59***	--			
	PRI	.72***	.14	--		
	WMI	.59***	.25	.20	--	
	PSI	.52***	.05	.19	.21	--
ICR						
	FSIQ	--				
	VCI	.67***	--			
	PRI	.74***	.32*	--		
	WMI	.73***	.34*	.40**	--	
	PSI	.58***	.09	.23	.37**	--

(cont. on next page)

Table 18 (continued)

		FSIQ	VCI	PRI	WMI	PSI
Mainstream						
	FSIQ	--				
	VCI	.55	--			
	PRI	.87**	.23	--		
	WMI	.78*	.24	.60	--	
	PSI	.66	-.07	.62	.58	--

Note. FSIQ = Full Scale IQ; VCI = Verbal Comprehension Index; PRI = Perceptual Reasoning Index; WMI = Working Memory Index; PSI = Processing Speed Index

*p < .05, ** p< .01, *** p < .001

Table 19

Correlation Between WISC-IV and Math Placement

		FSIQ	VCI	PRI	WMI	PSI
Resource						
	FSIQ	--				
	VCI	.62***	--			
	PRI	.71***	.17	--		
	WMI	.60***	.21	.22	--	
	PSI	.60***	.10	.27*	.31*	--
ICR						
	FSIQ	--				
	VCI	.69***	--			
	PRI	.74***	.32*	--		
	WMI	.76***	.44**	.45**	--	
	PSI	.57***	.12	.20	.29	--

(cont. on next page)

Table 19 (continued)

		FSIQ	VCI	PRI	WMI	PSI
Mainstream						
	FSIQ	--				
	VCI	.53*	--			
	PRI	.74***	.04	--		
	WMI	.60**	.15	.25	--	
	PSI	.30	-.14	.00	.29	--

Note. FSIQ = Full Scale IQ; VCI = Verbal Comprehension Index; PRI = Perceptual Reasoning Index; WMI = Working Memory Index; PSI = Processing Speed Index

*p < .05, ** p< .01, *** p < .001

Inferential Statistics

Relationship Between Eligibility Method and Academic Placement

A Chi-Square was conducted to examine the relationship between the type of SLD eligibility methodology and academic placement for English Language Arts and Mathematics. As can be seen by the frequencies cross tabulated in Table 20, the relationship between eligibility method and English Language Arts placement was not significant, χ^2 (3, N = 116) = 2.43, p = .49. The relationship between eligibility method and Mathematics placement, as depicted in Table 21, was also not significant, χ^2 (2, N = 116) = 2.89, p = .24.

Table 20

Crosstabulation of Eligibility Method and ELA Placement

Eligibility	ELA Placement					
	Self-Contained	Resource	ICR	Mainstream	χ2	Φ
C-DM	2	33	26	3	2.43	1.45
AAD	0	24	24	4		

Note. C-DM = Concordance-Discordance Model; AAD = Ability Achievement Discrepancy Model; ICR = In-Class Resource

Table 21

Crosstabulation of Eligibility Method and Math Placement

Eligibility	Math Placement				
	Resource	In-Class Resource	Mainstream	$\chi 2$	Φ
C-DM	36	20	8	2.89	1.58
AAD	21	22	9		

Note. C-DM = Concordance-Discordance Model; AAD = Ability Achievement Discrepancy Model

Relationship Between Eligibility Method and Created Factor

A Chi-Square was conducted to examine the relationship between the types of SLD eligibility methodology C-DM created factor. As can be seen in Tables 22, the relationship between eligibility method and created C-DM factor was not significant, χ^2 (1, N = 173) = .02, p = .89.

Table 22

Crosstabulation of Classification Method and Created C-DM Factors

New C-DM Factor	Eligibility Method			
	C-DM	AAD	$\chi2$	Φ
Yes	38	29	.02	.01
No	59	47		

Note. C-DM = Concordance-Discordance Model; AAD = Ability Achievement Discrepancy Model

Comparisons Between Eligibility Method and Cognitive Functioning

An independent-samples *t*-test was conducted to examine the differences between WISC-IV Full Scale IQ and eligibility method. There was a significant difference in Full Scale IQ between C-DM (M = 98.02, SD = 10.09) and the Ability-Achievement Discrepancy (M = 92.88, SD = 11.13) model; $t(171)=3.18$, $p < .01$, two-tailed, $d = .48$. Independent-samples *t*-tests were also conducted to examine differences between index scores and eligibility method. There was a significant difference in Verbal Comprehension Index scores between C-DM (M = 100.28, SD = 10.09) and AAD (M = 95.89, SD = 9.79); $t(171)=2.87$, $p <.01$, two-tailed, $d = .44$. A significant difference was also found in Perceptual Reasoning between C-DM (M = 101.49, SD = 12.70) and AAD (M = 94.21, SD = 11.58); $t(171)=3.89$, $p <.001$, two-tailed, $d = .60$. There was no significant differences between Working Memory between C-DM (M = 94.36, SD = 11.80) and AAD (M = 92.61, SD = 10.41); $t(171)=1.02$, $p = .31$, two-tailed, $d = .16$. No significant differences were reported in Processing Speed between C-DM (M = 94.48, SD = 13.77) and AAD (M = 93.88, SD = 12.98); $t(171)=.29$, $p = .77$, two-tailed, $d = .04$. These results, as depicted in Table 23, suggest that the students classified via the C-DM model had higher Full Scale IQ scores, Verbal Comprehension, and Perceptual Reasoning. No significant differences were found between students classified via the C-DM model and the AAD model in the areas of Working Memory and Processing Speed.

Table 23

Eligibility Method and WISC-IV Index Scores

WISC-IV Index	Eligibility Method			
	C-DM	AAD	*t*	*df*
Full Scale IQ	98.02	92.88	3.18**	171
	(10.09)	(11.13)		
VCI	100.28	95.89	2.87**	171
	(10.09)	(9.79)		
PRI	101.49	94.21	3.89***	171
	(12.70)	(11.58)		
WMI	94.36	92.61	1.02	171
	(11.80)	(10.41)		
PSI	94.48	93.88	.29	171
	(13.77)	(12.98)		

Note. VCI = Verbal Comprehension Index; PRI = Perceptual Reasoning Index; WMI = Working Memory Index; PSI = Processing Speed Index.

** = $p \leq .01$, *** = $p \leq .001$. Standard deviations appear in parentheses below means.

Eligibility method and WISC-IV subtests. A series of independent-samples *t*-tests were performed to investigate differences on WISC-IV core subtests between students found eligible for SLD through the C-DM and AAD models. Within the Verbal Comprehension Index, there was a significant difference in the scores on the Similarities subtest for those classified through C-DM (M = 10.20, SD = 2.25) than through AAD (M = 9.42, SD = 2.02); $t(171)=2.35$, $p < .05$, two-tailed, d = .36 and on the Vocabulary subtest for those classified through C-DM (M = 9.90, SD = 2.22) than through AAD (M = 8.97, SD = 2.35); $t(171)=2.65$, $p < .01$, two-tailed, d = .41. There was no significant difference in the scores on the Comprehension subtest (C-DM [M = 10.46, SD = 2.30]; AAD [M = 9.78, SD = 2.23]; $t(170)=1.96$, $p = .05$, two-tailed, d = .30). Within the Perceptual Reasoning Index, there was a significant difference in the scores on the Block Design subtest for those classified through C-DM (M = 10.00, SD = 2.69) than through AAD (M = 8.45, SD = 2.47); $t(171)=3.90$, $p < .001$, two-tailed, d = .60. No significant differences were noted in the scores on the Picture Concepts subtest for those classified through C-DM (M = 10.51, SD = 2.55) than through AAD (M = 9.83, SD = 2.61); $t(171)=1.72$, $p = .09$, two-tailed, d = .26. There was a significant difference in the scores on the Matrix Reasoning subtest for those classified through C-DM (M = 10.29, SD = 2.70) than through AAD (M = 8.87, SD = 2.11); $t(171)=3.77$, $p < .001$, two-tailed, d = .58. No significant differences were reported in either of the Working Memory Index subtests, nor were any significant differences noted in either of the Processing Speed subtests between those found eligible through C-DM or AAD models.

These results, which are depicted in Table 24, indicate that students who were found eligible for special education services through the C-DM model scored significantly higher than those classified through AAD in the areas of Similarities, Vocabulary, Block Design, and Matrix Reasoning. Although significant differences were noted between Verbal Comprehension and Perceptual Reasoning, further analysis revealed that no significant differences were observed in the areas of Comprehension and Picture Concepts for those identified through C-DM and AAD.

Table 24

Eligibility Method and WISC-IV Subtest Scores

WISC-IV Subtest	Eligibility Method			
	C-DM	AAD	*t*	*df*
Similarities	10.20	9.42	2.35*	171
	(2.25)	(2.02)		
Vocabulary	9.90	8.97	2.65**	171
	(2.22)	(2.35)		
Comprehension	10.46	9.78	1.96	170
	(2.30)	(2.23)		
Block Design	10.00	8.45	3.90***	171
	(2.69)	(2.47)		
Picture Concepts	10.51	9.83	1.72	171
	(2.55)	(2.61)		
Matrix Reasoning	10.29	8.87	3.77***	171
	(2.70)	(2.11)		
Digit Span	8.96	8.29	1.83	171
	(2.39)	(2.38)		
Letter-Number	9.28	9.33	-.13	171
	(2.58)	(2.43)		
Coding	8.59	8.24	.83	171
	(2.85)	(2.68)		
Symbol Search	9.39	9.61	-.53	171
	(2.63)	(2.60)		

* = $p \leq .05$, ** = $p \leq .01$, *** = $p \leq .001$. Standard deviations appear in parentheses below means.

Comparisons Between Eligibility Method and Academic Achievement

Another series of independent-samples *t*-tests were performed to investigate differences on academic achievement between students found eligible for SLD through the C-DM and AAD models, which is demonstrated in Table 25. There was a significant difference in the scores on the Reading Composite for those classified through C-DM (M = 85.60, SD = 10.11) than through AAD (M = 90.81, SD = 9.21); $t(166)=-3.43$, $p < .01$, two-tailed, d = -.53. Scores on the Reading Comprehension for those classified through C-DM (M = 89.35, SD = 12.11) were significantly lower than students identified through AAD (M = 93.01, SD = 8.60); $t(167)=-2.21$, $p < .05$, two-tailed, d = -.34. Word Reading was another area that indicated significantly lower scores for those eligible through C-DM (M = 87.46, SD = 11.60) than through AAD (M = 93.83, SD = 9.72); $t(160)=-3.73$, $p < .001$, two-tailed, d = -.30. There was a significant difference in the scores on the Decoding subtest for those classified through C-DM (M = 86.00, SD = 14.03) than through AAD (M = 91.61, SD = 15.88); $t(127)=-2.13$, $p < .05$, two-tailed, d = -.38. Interestingly, there was no significant difference in the scores on the Reading Fluency subtest for those classified through C-DM (M = 10.46, SD = 2.30) than through AAD (M = 9.78, SD = 2.23); $t(101)=-1.87$, p = .06, two-tailed, d = -.37.

The Math Composite did not reveal any differences between the two eligibility methodologies (C-DM [M = 89.86, SD = 12.41], AAD [M = 90.44, SD = 11.76]; $t(166)=-.31$, p = .76, two-tailed, d = -.05. There was no significant difference in the scores on the Math Calculation subtest for those classified through C-DM (M = 91.18, SD = 12.68) than through AAD (M = 92.62, SD = 12.75); $t(169)=-.74$, p = .46, two-tailed, d = -.11.

Math Problem Solving did not reveal any meaningful difference between those classified through C-DM (*M* = 93.05, *SD* = 11.59) or AAD (*M* = 92.85, *SD* = 11.32); $t(166)=.11$, $p = .91$, two-tailed, $d = .02$. There was not a significant difference in the scores on the Oral Expression subtest between C-DM (*M* = 95.94, *SD* = 13.62) and AAD (*M* = 95.74, *SD* = 11.38); $t(86)=.07$, $p = .94$, two-tailed, $d = .02$. No significant differences were found in the area of Listening Comprehension between those classified through C-DM (*M* = 99.00, *SD* = 12.27) and AAD (*M* = 97.45, *SD* = 11.53); $t(104)=.67$, $p = .51$, two-tailed, $d = .13$.

There was a significant difference in the scores on the Broad Written Language subtest between those classified through C-DM (*M* = 86.43, *SD* = 10.73) and AAD (*M* = 92.23, *SD* = 8.58); $t(146)=-3.56$, $p < .001$, two-tailed, $d = -.59$. Written Expression yielded differences between C-DM (*M* = 90.70, *SD* = 11.76) and AAD (*M* = 94.36, *SD* = 10.54); $t(157)=-2.04$, $p < .05$, two-tailed, $d = -.33$. Last, there was a significant difference in the scores on the Spelling subtest for those classified through C-DM (*M* = 86.02, *SD* = 11.43) than through AAD (*M* = 93.92, *SD* = 8.62); $t(165)=-4.93$, $p < .001$, two-tailed, $d = -.77$.

These results indicate that students who were found eligible for special education services through the C-DM model scored significantly lower than those classified through AAD on the Reading and Written Language Composites. Further analysis revealed that significant differences were observed in the areas of Reading Comprehension, Word Reading, Decoding, Written Expression, and Spelling for those identified through C-DM and those through AAD. Reading fluency scores did not differ significantly. No differences were noted on the Mathematics composite, nor were any significant differences reported in the areas of Mathematical Calculation and

Mathematical Problem Solving. Last, there were no significant differences between the two groups in the areas of Oral Expression and Listening Comprehension.

Table 25

Eligibility Method and Academic Achievement

Academic Area	Eligibility Method			
	C-DM	AAD	*t*	*df*
Reading Composite	85.60	90.81	-3.43***	166
	(10.11)	(9.21)		
Reading Comprehension	89.35	93.01	-2.21*	167
	(12.11)	(8.60)		
Reading Fluency	88.89	92.71	-1.87	101
	(9.54)	(11.09)		
Word Reading	87.46	93.83	-3.73***	160
	(11.60)	(9.72)		
Decoding	86.00	91.61	-2.13*	127
	(14.03)	(15.88)		
Math Composite	89.86	90.44	-.31	166
	(12.41)	(11.76)		
Math Calculation	91.18	92.62	-.74	169
	(12.68)	(12.75)		
Math Problem Solving	93.05	92.85	.11	166
	(11.59)	(11.32)		

(cont. on next page)

Table 25 (continued)

Academic Area	Eligibility Method			
	C-DM	AAD	*t*	*df*
Oral Expression	95.94	95.74	.07	86
	(13.62)	(11.38)		
Listening Comprehension	99.00	97.45	.67	104
	(12.27)	(11.53)		
Broad Written Expression	86.43	92.23	-3.56***	146
	(10.73)	(8.58)		
Written Expression	90.70	94.36	-2.04*	157
	(11.76)	(10.54)		
Spelling	86.02	93.92	-4.93***	165
	(11.43)	(8.62)		

*Note.** = $p \leq .05$, *** = $p \leq .001$. Standard deviations appear in parentheses below means.

Comparisons Between Cognitive Functioning and SLD Subtype

A one-way analysis of variance (ANOVA) was used to test for differences of scores on the WISC-IV Full Scale IQ and the WISC-IV Index scores among seven C-DM subtypes. Full Scale IQ scores differed significantly across the seven C-DM subtypes, F (6, 90) = 2.50, $p < .05$. Tukey post-hoc comparisons of the seven groups indicated that the Math SLD subtype (M = 89.58, 95% CI [83.19, 95.98]) recorded significantly lower FSIQ than the Mixed Reading/Written Expression SLD subtype (M = 102.75, 95% CI [98.90, 106.60). The Perceptual Reasoning Index scores differed significantly across the seven C-DM subtypes, F (6, 90) = 9.16, $p < .01$. Tukey post-hoc comparisons of the seven groups indicated that the Reading SLD subtype (M = 97.19, 95% CI [93.86, 100.52]) reported significantly higher PRI than the Math SLD subtype (M = 83.05, 95% CI [73.97, 92.20]). The Math SLD subtype reported significantly lower PRI than the Mixed Reading/Math SLD subtype (M = 108.00, 95% CI [91.20, 124.80]), Mixed Reading/Written Expression SLD subtype(M = 106.40, 95% CI [102.08, 110.72]), Mixed Math/Written Expression subtype(M = 107.33, 95% CI [99.74, 114.92]), and Mixed Reading/Math/Written Expression subtype (M = 106.06, 95% CI [102.38, 109.75]). Table 26 depicts the results of the one-way ANOVA.

Table 26

Comparison Between Cognitive Functioning and SLD Subtype

WISC-IV	SLD Subtype								
	1	2	3	4	5	6	7	*F*	η^2
FSIQ	96.62	89.58	97.67	98.17	102.75	101.33	98.84	2.50*	.14
	(10.26)	(10.07)	(12.06)	(7.49)	(8.23)	(4.16)	(10.26)		
VCI	97.19	98.00	100.33	99.00	104.95	99.00	100.59	1.19	.07
	(7.32)	(7.87)	(3.22)	(8.49)	(7.51)	(8.89)	(13.54)		
PRI	97.71	83.08	101.33	108.00	106.40	107.33	106.06	9.16***	.38
	(6.79)	(14.34	(11.72)	(16.01)	(9.23)	(3.06)	(10.22)		
WMI	94.33	93.67	99.33	88.33	95.90	97.33	94.06	.43	.03
	(16.32)	(8.29)	(12.22)	(10.11)	(10.00)	(15.54)	(10.96)		
PSI	99.90	92.25	87.67	95.17	96.40	96.00	90.94	1.16	.07
	(13.07)	(13.77)	(12.50)	(10.03)	(14.06)	(12.12)	(14.52)		

Note. FSIQ = Full Scale IQ; VCI = Verbal Comprehension Index; PRI = Perceptual Reasoning Index; WMI = Working Memory Index; PSI = Processing Speed Index; 1 = Reading SLD Subtype; 2 = Math SLD Subtype; 3 = Written Expression Subtype; 4 = Mixed Reading/Math SLD Subtype; 5 = Mixed Reading/Written Expression SLD Subtype; 6 = Mixed Math/Written Expression SLD Subtype; 7 = Mixed Reading/Math/Written Expression Subtype

*$p < .05$, ***$p < .001$. Standard deviations appear in parentheses below means.

Chapter 5

Discussion

The current study was designed to examine the impact of the Concordance-Discordance Model on identifying eligibility of students for special education under the classification of specific learning disability when compared with the eligibility of students previously identified through the ability-achievement discrepancy model. The study was designed to determine if there are differences in the number of students identified with a specific learning disability with the use of the C-DM approach versus the use of the ability-achievement discrepancy model. In addition, the current study investigated cognitive and academic profile differences, as well as academic placements, between the students identified via C-DM and AAD.

Are students who were previously classified through the ability-achievement discrepancy model less likely to be identified through C-DM? The results of the study indicated that little more than slightly more than half of the students in the sample of classified students were found eligible for special education through C-DM. The implementation of C-DM reduced the percentage of students eligible for services by over 40 percent, which suggests that the model is more stringent with SLD identification, when compared with the use of AAD.

Are students who are receiving intensive supports more likely to be identified through the ability-achievement discrepancy model or Concordance-Discordance Model? Are there significant differences in identification methods and student placement for English Language Arts and Mathematics? No differences were noted between the number of students placed in a pullout replacement resource, in an in-class resource, or in a mainstream setting based upon the eligibility method for English Language Arts or Mathematics. The finding that there are no differences between the two groups is particularly alarming. Considering the fact that C-DM is a more accurate way to identify children with learning disabilities and also has the potential to lead to more effective interventions (Hale & Fiorello, 2004), the findings suggest that there are a substantial number of students in restrictive placements that should not be classified as special education students.

Are there significant differences in the cognitive profiles and academic achievements of students identified through the ability-achievement discrepancy model and the Concordance-Discordance Model? When investigating profile differences, students identified through C-DM recorded significantly higher Full Scale IQs than those classified through the AAD model. In addition, students eligible through C-DM demonstrated stronger Verbal Comprehension and Perceptual Reasoning than those identified through AAD. When the subtest scores were further analyzed, significantly higher scores were reported on the Similarities and Vocabulary subtests for C-DM. No differences were noted on the Comprehension subtest between the two groups. Within the Perceptual Reasoning Index, differences were noted on the Block Design and Matrix Reasoning subtests; those eligible through C-DM recorded higher scores. Not surprisingly, differences were not indicated on any of the Working Memory Index or Processing Speed Index scores. Although the C-DM group scored higher on the Similarities, Vocabulary, Block Design, and Matrix Reasoning subtests, these finding appear to be consistent with the model. According to Hale and colleagues (Hale & Fiorello, 2004; Hale et al., 2003; Hale et al., 2008), cognitive strengths consist of the

Verbal Comprehension Index and Perceptual Reasoning Index. Of the eight created factors, at least seven require a combination of one of these subtests and three of the created factors require two of the subtests. Interestingly, creating factor scores did not change the likelihood of identifying a student eligible through C-DM or AAD. Although creating new factor scores did not significantly impact student eligibility, students with true SLD have cognitive deficits in the basic psychological processes that often lead to academic failure. These impairments render a global IQ score meaningless (Kavale et al., 2005) and stress the importance of evaluating students at an index and subtest level.

Do academic achievement areas differ by domain (reading, writing, and mathematics)? Academically, students identified through C-DM tended to score significantly lower on achievement measures, particularly in the areas of reading and writing. Performance on the Reading Composite, Reading Comprehension, Word Reading, and Decoding subtests were significantly lower for the C-DM students. In terms of writing, students identified through C-DM performed lower on the Broad Written Expression, Written Expression, and Spelling domains. Interestingly, no differences were noted between the two groups on the Math Composite, Math Calculation, or Math Problem Solving tasks.

It is important to recall that CD-M requires identification of specific academic and cognitive deficits, as we well as average intelligence. In students with SLD, there exists an empirical and meaningful relationship between the academic and cognitive deficits, because the cognitive deficit is the assumed cause of the academic deficit (Flanagan et al., 2010). The pattern of cognitive and academic strengths and weakness as highlighted in the current study reflects the concept of unexpected underachievement, which is the hallmark of the SLD construct. The need to document a deficiency in an academic skill is at the core of the SLD identification processes because it establishes the idea that a student's ability to learn is impaired. The students identified through CD-M exhibited cognitive strengths (i.e., Verbal Comprehension, Perceptual Reasoning, etc.), academic weaknesses, and cognitive weaknesses.

Are there cognitive differences within identified specific learning disability areas? Full Scale IQ differed significantly between SLD subtypes, indicating students identified with the Mixed Reading/Written Expression subtype performed significantly higher on global cognitive measures than did the Math SLD subtype. The Math SLD subtype also recorded significantly lower scores on Perceptual Reasoning than did the Mixed Reading/Math SLD, Mixed Reading/Written Expression, Mixed Math/Written Expression, and Mixed Reading/Math/Written Expression subtypes. Visual Processing (*Gv*), which can significantly predict Math Computation (Hale, Fiorello, Kavanagh, Hoeppner, & Gaither, 2001), was an area of weakness for students with the Math SLD subtype.

Significant, positive relationships were noted between the Reading Composite and Full Scale IQ, Verbal Comprehension, and Working Memory for students identified through C-DM. Word Reading was correlated with Verbal Comprehension, but no other areas of reading were related to Full Scale IQ or other index scores. Conversely, significant, positive relationships were indicated for the Reading Composite, Reading Comprehension, Reading Fluency, and Word Reading across both Full Scale IQ and Verbal Comprehension for those eligible through AAD. In terms of the math, the Math Composite, Math Calculation, and Math Problem Solving were noted to have significant, positive relationships with Full Scale IQ, Verbal Comprehension, Perceptual Reasoning, and Working Memory for students identified through C-DM and AAD.

Limitations of the Study

Several issues should be considered regarding limitations of the present study before implications are interpreted from the results. The students whose test scores were utilized for the study came primarily from three school districts in southern New Jersey. Considering this limitation, these results might not generalize to other states and general populations throughout the country. Complete demographic information was not collected, which limits the ability to discuss ethnicity or socio-economic status. Results may not generalize to other samples of students with differing demographic characteristics.

The majority of the data from students included in the final sample came from a convenience sample, which included a large percentage of students whose cognitive assessment was performed by a school psychologist and learning evaluation completed by a learning disabilities teacher-consultant. Most of the students in the sample were evaluated by two evaluators as opposed to the same evaluator for both cognitive and academic measures. This lack of uniformity between examiners may have led to inconsistencies in both standardization procedures during testing and scoring/test interpretation. The final sample consisted of students from both public and nonpublic schools. The current study attempted to examine the academic placements of students classified SLD; however, the nonpublic school district students were not included in this sample because the schools did not offer academic placements comparable with the public school (i.e., all academic instruction in the nonpublic schools occurred in the general education setting). Therefore, 57 of the 173 students were removed from this data set for the analysis.

The Concordance-Discordance Model allows the practitioner to create a new factor by averaging subtest scores that cluster together clinically; however, averaging their reliability coefficients for SED calculation is questionable (Hale & Fiorello, 2004). In the current study nearly 40 percent of the students identified through C-DM resulted from a created factor score. Even though creating new factor scores did not increase the likelihood of eligibility for special education, it is important to consider the number of students identified by creating a new factor. Although averaging reliability coefficients is questionable, it is more effective than using a composite score in which the tests significantly differ from one another (Hale & Fiorello, 2004).

When reviewing the cognitive strengths/weaknesses noted by C-DM, *Gc*, *Gf*, and *Gv* are accounted for in the model. Weaknesses are considered for *Gsm* and *Gs*, but the model lacks a cognitive strength component for these areas. There also appears to be a gap in identifying processing strengths and weaknesses in the areas of *Ga* and *Glr*. Due to the atheoretical nature of the WISC-IV and the lack of *Ga* and *Glr* representation, it may be necessary to supplement the evaluation through a Cross-Battery Assessment (XBA). The XBA approach is based on CHC theory and is also integrated with neuropsychological theory. The XBA approach provides practitioners with a way to make systematic, reliable, and theory-based interpretations of any ability battery and to augment that battery with cognitive, achievement, and neuropsychological subtests from other batteries to gain a more psychometically defensible and complete understanding of a student's pattern of strengths and weaknesses (Flanagan et al., 2013). A more comprehensive evaluation may be needed in order to further explore the student's profile, particularly when creating factors to identify cognitive strengths and weaknesses. For example, the created factor Alphabetic Principle may be more effectively investigated through the administration of the Process Assessment of the Learner – Second Edition (PAL-II) rather than through the Digit Span and Coding subtests on the WISC-IV.

Much of the recent research on cognitive-academic relationships has been interpreted within the context of CHC theory and with specific instruments developed for CHC theory (Flanagan et al., 2011, Flanagan et al., 2013) and has implications for intervention. Narrow abilities in seven broad CHC domains appear to be related to reading achievement. Narrow abilities subsumed by *Ga*, *Gc*, *Glr*, *Gsm*, and *Gs* display the most consistent, significant relationships with reading achievement. Measures of phonological processing or awareness (e.g., Phonetic Coding [PC], which is subsumed by *Ga*) show strong and consistent relationships with reading achievement across many studies, particularly during the early elementary years (Flanagan et al., 2013). *Gc* abilities, which typically are measured though Lexical Knowledge, Listening Ability, Language Development, and General Information, are significantly related to reading achievement. *Gsm* also contributes to reading achievement through working memory processes (Hale & Fiorello, 2004). Reading achievement literature suggests that *Gsm*, including working memory and memory span, contributes significantly to the prediction of reading achievement (Flanagan et al., 2013). The relationship between *Glr* and reading achievement is consistent across school-aged children. Associate Memory and Naming Facility are important in early elementary years, and Meaningful Memory is necessary later on for reading comprehension. *Gs* appears to be related both to basic reading skills and to reading comprehension in early years. *Gf* and *Gv* abilities appear to be less closely related to reading achievement. Inductive and deductive reasoning appear to be more closely related to reading comprehension.

In terms of math, *Gc*, *Gsm* (working memory), and *Gs* are significantly related to math achievement. There are stronger relationships between *Gf* and *Gv* abilities and math achievement. The *Gf*, *Gc*, and *Gs* abilities have correlated consistently and significantly with basic math skills and math problem solving. The *Gc* relationship increases with age, whereas *Gs* relation is strongest during the elementary years. *Gf* was related consistently to mathematics achievement at levels higher than all other CHC abilities across age. Many executive functions are considered important for math achievement, including selective attention, planning, organizing, and self-monitoring.

Overall, several CHC abilities and neuropsychological processes are related significantly to writing achievement. The most consistent relationships appear to be with *Ga* (phonetic coding), *Gsm* (memory span), *Gs* (perceptual speed), and Gc (lexical knowledge, language development, and general information). In addition, visual-motor integration (*Gp*) and retrieval fluency (*Glr*) are important.

Students with difficulties in Auditory Processing often demonstrate difficulties hearing information presented orally and with initially processing oral information. Acquiring phonetic skills, sounding out words, using phonetic strategies, spelling, poor quality of writing, note taking, and reading word problems are manifestations of this cognitive weakness. Without establishing a processing weakness in this area, intervention may not target specific deficits. Phonological awareness/processing is important during the elementary school years for reading achievement, basic writing skills and written expression. Processing strengths/weaknesses related to *Ga* could be obtained through the administration of the PAL- II (Rhyming, Syllables, Phonemes), KTEA-II (Phonological Awareness), NEPSY-II (Phonological Processing), DAS-II (Phonological Processing), WJ III (Sound Awareness, Sound Blending, and Incomplete Words subtests), or CTOPP-2 (Blending and Segmenting subtests).

Students will difficulties in Long-Term Retrieval typically demonstrate trouble learning new concepts and retrieving information by using association. Performing consistently across different task formats is a concern. In addition, rapid retrieval of information, learning new information quickly, generating ideas rapidly, and recalling specific information is problematic. Reading difficulties manifest in the inability to access background knowledge to support new learning while reading. Slow access to phonological representations during decoding creates reading difficulties. Idea generation/production, accessing words to use during essay writing, and completing specific writing tasks are areas of concern. Recalling and memorizing math facts and procedures can be problematic for students with weaknesses in *Glr*.

Last, it is important to note that C-DM is predicated on the notion of a disorder in one or more the basic psychological processes. However, there is no legal requirement to document a processing disorder based on federal law or regulation. An assessment for a processing disorder might be requested if the state's regulations require documentation of a processing disorder linked to the area of educational deficit or if the IEP team believes it would be helpful either in establishing a disabled child's educational needs or in planning a remedial program. The Office of Special Education Programs (OSEP) has taken the position that federal law and regulations do not require documentation of a processing disorder, although it has allowed states to impose this documentation based on the congressional definition (McBride, Dumont, & Willis, 2011). OSEP suggested that states and local school districts may develop criteria for defining a disorder in one or more of the basic psychological processes at their option, but requiring a psychological processing disorder for SLD classification is not an additional criterion. In the 2006 Final Regulations, OSERS indicated that the Department does not believe that an assessment of psychological or cognitive processing should be required in deciding whether or not a student has an SLD. However, § 300.309(a)(2)(ii) permits, but does not require, consideration of a pattern of strengths and weaknesses, or both, relative to intellectual development, if the evaluation group considers that information relevant to an identification of SLD (McBride et al., 2011).

Implications and Future Direction

The current study suggested that the implementation of C-DM reduces the number of students eligible for special education when compared with the use of the AAD model. With that in mind, if one were to adopt C-DM, then fewer students would be classified SLD. It is important to consider the implication for these students who are underachieving, but do not qualify for special education. Although a more rigorous and systematic approach to SLD identification is necessary, provisions must be in place for students with and without disabilities.

A question posed between the implementation of the draft regulations in 2004 and Final Regulations in 2006 was, "What would happen to all the students classified using the ability-achievement discrepancy model who did not qualify using a new methodology?" The Office of Special Education and Rehabilitative Services recommend exercising great caution in dismissing students just because the procedures had changed. McBride et al. (2011) suggested that after three years of special educational services, an IEP team would have to conclude, that in addition to no longer meeting whatever arbitrary cutoff was established, the student would no longer need the support services he or she was receiving in order to continue progress before exiting him or her. States that change their eligibility criteria for SLD may need to consider carefully the re-evaluation of students previously found eligible for special education using prior methods. States should consider the impact of exiting a student from special education program when he or she has received these services for many years; another consideration is how the removal of these supports will affect the student's educational progress. This is a particular concern for a student who is in the final years of high school. The group should consider whether or not the student's instruction and overall special education program has been appropriate as part of this process. If the special education instruction has been appropriate and the child has not been able to exit special education, this would be strong evidence that the student's eligibility needs to be maintained (McBride et al., 2011).

In addition, rather than taking the position that practitioners adopt either RTI or comprehensive evaluations for SLD identification, it is important to do both. RTI should be an essential part of a systemic prevention, intervention, and identification process. If the student responds appropriately to the intervention, there is no need for cognitive assessments. Subsequently, if the student does not respond to the intervention, then a comprehensive evaluation is necessary. Hale et al. (2006) proposed a three-tier Balanced Practice Model for SLD identification process, which includes a standardized RTI protocol at Tier 1, a problem-solving RTI model at Tier 2, and a comprehensive evaluation model at Tier 3. The standard protocol at Tier 1 is carried out by classroom teachers through the use of standardized curriculum based measures (CBM) to evaluate student progress in relationship to instructional benchmarks. The students are exposed to a standardized, research-based instructional format, which can be compared to other students' instructional format. If the students are deemed as nonresponders, an individualized problem-solving approach would be undertaken at Tier 2. At this level the problem can be operationalized and analyzed and individualized interventions can be implemented. Tier 2 is viewed as a flexible problem solving approach, allowing for interventions to take place in the general education classroom, in small groups, or on an individual basis. Tier 1 is designed to ensure external validity, and Tier 2 emphasizes internal validity (Hale et al., 2006). If the student is unresponsive at Tiers 1 and 2, then a comprehensive evaluation that includes the evaluation of basic psychological processes would be undertaken at Tier 3. If cognitive processing and achievement deficits are noted, then the child would meet the criteria for SLD classification.

This three-tier model would not only allow teachers and school psychologists to recognize difficulties and intervene early to prevent SLD, but also result in evaluation procedures that increase diagnostic sensitivity for SLD (Hale et al., 2006). Because many students would be served in Tiers 1 and 2, school psychologists would have more time to do both RTI and cognitive assessments. Through the use of CBM data collection at Tier 1, functional analysis and single-subject data at Tier 2, and cognitive and neuropsychological data at Tier 3, diagnostic accuracy is increased and direct interventions can more effectively address weaknesses. The information gathered from the RTI standard protocol, RTI problem-solving, and comprehensive evaluation tiers can provide the development of individualized instruction designed to meet the unique needs of those who qualify and those do not qualify for special education services.

As with most alternatives to the discrepancy and RTI-only approaches, C-DM expands the methods of assessment that are available and culminates in a comprehensive understanding of the student. Gathering data from a variety of assessment tools, including cognitive and neuropsychological tests is essential when students do not adequately respond to interventions. Educating teachers and practitioners about the value of cognitive and neuropsychological assessment is an important step in SLD identification. This is a role that can be undertaken by school psychologists. Identification of learning disabilities is complex and requires empirical and clinical knowledge on the part of practitioners. Students with neurologically based difficulties require specifically designed instruction in order to make academic gains. The real value added from C-DM is that the data can influence intervention and result in better outcomes for children with specific learning disabilities.

A future direction could include replicating the methods with a larger, more representative sample size. This was a particular area of concern when interpreting differences between SLD subtypes. A larger sample size could lead to a cluster analysis of subtest scores and further examine the cognitive strengths and weaknesses of students within each SLD subtype. Also, with the anticipated release of the Wechsler Intelligence Scale for Children – 5th edition (Fall 2014), the study could be replicated using this measure. With separate visual spatial and fluid reasoning composites, as well as new measures of naming facility, associative memory, and visual working memory, it may be possible to review and create new C-DM factor scores that fall more in line with CHC theory.

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Appendix A

Request for Data Letter

Dear School Psychologist/LDT-C,

We would appreciate your participation in a study entitled *The Effectiveness of the Concordance-Discordance Model: Identifying Learning Disabilities in School-Aged Children.* The research is being conducted by Bryan J. Hendricks, Psy. D. Candidate, as a partial requirement for the Doctor of Psychology degree, and the principal investigator and supervisor of the research project is Lisa A. Hain, Psy.D.

The purpose of this project is to examine differences between the ability-achievement discrepancy model and concordance-discordance model for SLD identification. The archival data sought includes scores from the Wechsler Intelligence Test for Children – Fourth Edition (WISC-IV) and any individually-administered standardized achievement test.

We are asking you to provide standard scores/scaled scores of the intelligence and achievement tests. As this is an archival record review, there will be no contact between myself or Dr. Hain and the child, family, or team members. In fact, we ask you to only report the intelligence test, achievement test, age, grade, gender, disability label and present English and Mathematics placement, without including the child's name or any other identifying information. There is no harm to the students or any involvement of the students needed. All data will be presented in summative form, with no individual data identified. Although there will be no direct benefit to the individual child, we will be willing to provide participants with a summary of the results after the study is completed.

We thank you for your possible participation. If you wish to participate, you will be asked to sign an agreement form indicating that you have provided permission for the archival data to be utilized in this study. If you need further assistance or have any questions, please contact either Bryan J. Hendricks at bryanhen@pcom.edu or Lisa A. Hain at LisaHai@pcom.edu.

______________________________ _______________________

Bryan J. Hendricks, Ed.S., NCSP, ABSNP Lisa A. Hain, Psy. D.

Appendix B

School Psychologist/Learning Consultant Agreement

School Psychologist/LDT-C Name: ________________________

School: ________________________

Date: ________________________

I, ______________________________, hereby allow the use of my archival WISC-IV, and standardized achievement test scores in the research project entitled *The Effectiveness of the Concordance-Discordance Model: Identifying Learning Disabilities in School-Aged Children.* I understand the archival data will be anonymous and will not be reported by individual, practitioner, or school. I have obtained school district permission if needed for the release of this data.

Signatures:

____ Date: ________________
School Psychologist/LDT-C

____ Date: ________________
Director (Supervisor) of Special Education (if needed)

____ Date: ________________
Superintendent (if needed)

Appendix C

Dissertation: Student Data Collection Workbook

Participant Identification Code #:______________________

Date data was removed from student file:_________________________

Check that each assessment has scores provided in full.

______ WISC-IV Composite and Subtest Standard/Scaled Scores

______ WIAT-II/WIATIII and/or WJ-III ACH NU Standardized Achievement Test Composite and Subtest Standard Scores

Please indicate the following for the data file

Age When Tested: _________________

Grade: ________________

Gender: _______________

Current English/Language Arts placement: ___Mainstream (No Support) ___ In-Class Resource

___Pullout Resource ___ Self-Contained __ Other

Current Mathematics placement: ____Mainstream (No support) ___ In-Class Resource

___Pullout Resource ___ Self-Contained ____ Other

SLD Subtype(s): Check all that apply.

___ Oral Expression
___ Listening Comprehension
___ Basic Reading Skills
___ Reading Fluency Skills
___ Reading Comprehension
___ Math Calculation
___ Math Problem-Solving
___ Written Expression

WISC-IV Scores

Subtest	Scaled Score	Subtest	Scaled Score
Similarities		Block Design	
Vocabulary		Picture Concepts	
Comprehension		Matrix Reasoning	
*Information		*Picture Completion	
*Word Reasoning			

Subtest	Scaled Score	Subtest	Scaled Score
Digit Span		Coding	
**Digit Span Forward*		Symbol Search	
**Digit Span Backward*		*Cancellation	
Letter-Number Sequencing			
*Arithmetic			

*if administered/computed

Composite	Standard Score
Verbal Comprehension Index	
Perceptual Reasoning Index	
Working Memory Index	
Processing Speed Index	
Full Scale IQ	

Achievement Test Composite and Subtest Scores

Measure	Standard/Scaled Score
Reading Composite	
Basic Reading Skills	
Reading/Passage Comprehension	
Reading Fluency	
Word Reading	
Decoding	
Math Composite	
Math Calculation	
Math Problem Solving	
Oral Expression	
Listening Comprehension	
Broad Written Expression	
Written Expression	
Writing Fluency	
Spelling	