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Ability–Achievement Discrepancy, Response to Intervention, and Assessment of Cognitive Abilities/Processes in Specific Learning Disability Identification: Toward a Contemporary Operational Definition

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The category of specific learning disability (SLD) remains the largest and most contentious area of special education. A primary problem is overidentification of students with SLD as evidenced by the SLD category representing approximately 5% of the school population and 50% of the special education population. Partially responsible for this problem is the overreliance on the ability–achievement discrepancy criterion as the sole indicator of SLD, a practice that remains widespread. Recently, new ways to conceptualize and define SLD have been proposed in an attempt to remedy the overidentification problem (e.g., Fletcher, Coulter, Reschly, and Vaughn, 2004). Most popular is a model that conceptualizes SLD in terms of a failure to respond to intervention (RTI) (Berninger and Abbott, 1994).

The purpose of this chapter is to briefly review these two methods of SLD identification, the ability–achievement discrepancy criterion and RTI. It is our belief that neither of these methods, when used as the sole indicator of SLD, can identify this condition reliably and validly. This is because SLD may be present in students with *and without* a significant ability–achievement discrepancy (see Aaron (1997) for a comprehensive review) and in students who fail to respond *and who do respond favorably to* scientifically based interventions. We believe the missing component in both of these SLD methods is information on the student's functioning across a broad range of cognitive abilities and processes, particularly those that explain significant variance in academic achievement. Indeed, the federal definition of SLD is "a disorder in one or more of the basic psychological processes. . . " (Individuals with Disabilities Education Act [IDEA] 2004). Therefore, this chapter discusses evaluation of cognitive abilities/processes as defined by contemporary Cattell–Horn–Carroll (CHC) theory and its research base. Inherent in this discussion is a summary of the research on the relations between cognitive abilities/processes and academic achievement, information we believe is necessary to (a) determine whether a processing deficit(s) is the probable cause of a student's academic difficulties and (b) restructure and redirect interventions for nonresponders in an RTI model.

Keogh (2005) discussed criteria for determining the adequacy and utility of a diagnostic system, such as the ability–achievement discrepancy and RTI models. The criteria include *homogeneity* (Do category members resemble one another?), *reliability* (Is there agreement about who should be included in the category?), and *validity* (Does category membership provide consistent information?). Keogh (2005, p. 101) suggested that, SLD "is real and that it describes problems that are distinct from other conditions subsumed under the broad category of problems in learning and achievement." The question is how to best capture the distinctiveness of SLD. Having a significant ability–achievement discrepancy or being nonresponsive to treatment does not appear sufficient. Therefore, we offer an operational definition of SLD that (a) begins with an RTI method, (b) focuses on documentation of cognitive ability/processing deficits and integrities for nonresponders, (c) identifies a link between below-average processes and academic skills, and (d) does not require the identification of a significant ability–achievement discrepancy. As such, our operational definition is consistent with IDEA 2004 and its attendant regulations (34 CFR Part 300). It is our hope that this operational definition will meet Keogh's criteria for an adequate diagnostic system.

10.1 The Ability–Achievement Discrepancy Criterion

The discrepancy criterion has been the primary operational definition of SLD since 1977 when it was codified in federal law (US Office of Education, 1977). The origins of discrepancy and SLD identification are found in Bateman's (1965) definition and the discrepancy criterion is the primary means of identifying SLD to date (Reschly and Hosp, 2004). Nevertheless, over time, the discrepancy model has come under increasing criticism (e.g., Aaron, 1997; Gresham, 2002; Sternberg and Grigorenko, 2002), leading to recommendations that this method be eliminated (e.g., Lyon et al., 2001). Despite these recommendations, the reauthorization of IDEA does not eliminate the historically important discrepancy criterion but instead states that agencies shall *not be required* to use discrepancy in SLD identification procedures.

Whereas many of the arguments against the ability–achievement discrepancy method can be challenged on several bases (as discussed below; see also Kavale, Kaufman, Naglieri, and Hale, 2005, for a review), some of the arguments against ability–achievement discrepancy have merit. One of the major problems with the discrepancy model has been the failure to implement it in a steadfast manner (MacMillan, Gresham, and Bocian, 1998; MacMillan and Siperstein, 2002). Consequently, sometimes up to 50% of SLD populations have been found not to meet the required discrepancy criterion (Kavale and Reese, 1992). When the single stipulated identification criterion is not met, the basis for SLD status is not attained and the validity of the classification must be called into question. The implementation problem is not remedied by discrepancy models such as the one described by Peterson and Shinn (2002). For example, the *absolute achievement discrepancy* model represents SLD simply as the low end of the achievement distribution. The *relative achievement discrepancy* model compares individual student performance with other students in a particular school. These models fail because they make the context of evaluation (i.e., individual school setting) the primary influence on SLD determination. For example, in a school where the average student scores 90 on a norm-referenced assessment with a mean of 100 and a standard deviation of 15, a student with an IQ of 110 and achievement score of 85 would not appear to possess an academic problem, but a student with an IQ of 80 and achievement score of 75 might appear to be SLD in that context.

A related problem is the failure to recognize that discrepancy is actually the operational definition of *underachievement* (Thorndike, 1963); discrepancy is not the operational definition of SLD. It is, consequently, incorrect to assume that meeting the discrepancy criterion completes an SLD diagnosis (Kavale and Forness, 2000b). As originally conceptualized, the SLD construct was predicated on the presence of underachievement, not simply low achievement (LA) (Chalfant and King, 1976).

Complicating the notion of discrepancy as the operational definition of underachievement is the fact that all total intelligence test scores are not created equal. Therefore, whether or not a student displays a discrepancy is partly a function of the intelligence test used in an evaluation of suspected SLD. Suppose a student has reading difficulties because of slow processing speed (with other abilities within the average range). If the total test score from the Cognitive Assessment System (CAS; Das and Naglieri, 1997) were used in a discrepancy formula, then the student would be less likely to display a discrepancy than if the Kaufman Assessment Battery for Children–Second Edition (KABC-II; Kaufman and Kaufman, 2004) were used. This is because approximately half of the subtests that contribute to the CAS total test score are speeded (e.g., Keith, Kranzler, and Flanagan, 2001), whereas none of the subtests that contribute to the total test scores of the KABC-II are speeded.[1] A non-significant discrepancy may be found simply because the cognitive abilities/processes that are responsible for low achievement have attenuated the total test score, such as in the CAS example. If those specific abilities/processes could be removed from the total test score and in so doing a significant discrepancy emerged, then this finding would suggest underachievement. In short, while the finding of a non-significant discrepancy may rule out underachievement in some cases, it does not rule out underachievement in all cases.

Furthermore, while a significant discrepancy between ability and achievement represents underachievement in some cases, it does not represent underachievement in all cases. For example, an average reader (with standard scores of about 100 on reading tests) may have a full-scale IQ in the very superior range (e.g., >130) because of specific cognitive strengths in some, but not all, abilities that encompass the full-scale score. Practitioners who interpret this type of significant discrepancy (30 points or two standard deviations in this example) as underachievement have mistakenly assumed that a student who has superior ability in one area ought to have superior ability in all areas. This assumption is simply wrong. Significant variability in an individual's cognitive ability profile is common and, therefore, is to be expected (see McGrew and Knopik, 1996; Oakley, 2006). In summary, good readers may have IQs that are significantly above their standardized reading test scores simply because they have significant strengths in specific cognitive abilities/processes that make up IQ. It is important to recognize that these strengths are unusual, and indeed valuable, deviations from the norm. A student with significant strengths in some areas should not be diagnosed with SLD simply because they have average abilities in other areas. Average ability is not a disability. Nevertheless, average readers with superior IQs are mistakenly diagnosed as SLD routinely.

Critiques of the discrepancy model are often linked to calls for eliminating IQ tests in the SLD identification process (e.g., Siegel, 1989). These calls are part of the continuing vilification of IQ testing that, in reality, possesses little justification (see Carroll and Horn, 1981; Flanagan, Ortiz, Alfonso, and Dynda, 2006; Flanagan, Ortiz, Alfonso, and Mascolo, 2006; Gottfredson, 1997a, 1997b). Nevertheless, the wrongheaded view of IQ testing continues in the SLD field with the patently false view that intelligence tests are either not useful, irrelevant, or discriminatory in the identification process (Fletcher et al., 1998; Siegel, 1999). The IQ score is assumed irrelevant because it is confounded by achievement, but such a perception fails to consider how an IQ score can be a "good" predictor of academic skills if IQ and achievement are unrelated. The correlations between IQ and reading achievement range from $r = 0.30$ to $r = 0.80$ depending upon age, IQ test, and achievement assessment. These correlations are hardly irrelevant and support the predictive validity of intelligence tests. By accounting for about 50% of the variance in global achievement, an IQ score does not impose limits on academic performance as suggested by Siegel (1999). Additionally, the large proportion of unexplained variance makes it difficult to accept the assumption that low IQ *causes* SLD (Stanovich, 1999). In fact, most of the variability in specific academic skills is due to factors other than global IQ (e.g., *specific* cognitive abilities and processes, motivation, appropriateness of instruction, etc.), but IQ remains the best single predictor of global achievement as measured by standardized achievement tests (e.g., a total score from a standardized comprehensive achievement battery) (see Glutting, Yongstrom, Ward, Ward and Hale, 1997).

Because, the discrepancy model has historically sought to document underachievement at a global level (IQ–achievement difference), it is not surprising that IQ was found not to differentiate between reading disabled groups (i.e., IQ-discrepant versus IQ-nondiscrepant). Unfortunately, current research and critiques of SLD definitions continue to treat IQ under the outdated assumption that intelligence is solely "g" or general intelligence (Buckhalt, 2000). Although g is important for dealing with the complexity of everyday life (Gottfredson, 1997b), its sole value for SLD identification is in providing an expected achievement level (along with other variables such as motivation) necessary for determining the presence of under- or over-achievement and only

[1] The KABC-II has no timed subtests for children aged 3–7 years. A non-timed condition may be used for older children.

when the IQ is not attenuated by deficits in specific cognitive abilities/processes.[2]

Over time, cognitive ability tests have moved away from "g" (i.e., providing a single IQ score) and now, besides providing a total test score, assess multiple and complex theoretically validated cognitive abilities/processes (Flanagan and Kaufman, 2004; Flanagan and Ortiz, 2001; Kaufman and Kaufman, 2001). Consequently, new intelligence tests (e.g., WJ III, KABC-II) possess significant value for identifying individual differences in cognitive functioning *and* insight into the nature of underlying cognitive deficits and integrities. Would the body of research showing no differences between RD groups have differed using current intelligence tests that contain measures of valid cognitive constructs with known relations to reading achievement (e.g., phonological processing, working memory, processing speed, fluid reasoning)? We believe the answer to this question is "yes." There is much research available to support this conclusion (e.g., Evans, Carlson and McGrew, 1993; Flanagan, 2000; McGrew, Flanagan, Keith, and Vanderwood, 1997; Vanderwood, McGrew, Keith, and Flanagan, 2002). The interested reader is referred to Flanagan et al.'s (2006b) comprehensive summary of the relations between specific cognitive abilities/processes and reading, math, and written language achievement.

SLD also has been associated with "average" IQ levels, but there have been long-standing suggestions that SLD occurs at all IQ levels (e.g., Ames, 1968; Cruickshank, 1977). This seems ill-advised, because IQ levels in the below-average range (e.g., <85) introduce the "slow learner" problem and eliminate unexpected school failure from the SLD construct. Conversely, IQ levels in the above average to superior ranges are also problematic for SLD identification as mentioned above. To illustrate, Siegel (2003) criticized the discrepancy model for not identifying a student with an IQ of 130 and achievement score of 110. This criticism was unfounded because it is inappropriate to use the SLD designation for "relatively well-functioning students" (Flanagan, Keiser, Bernier, and Ortiz, 2003; Flanagan et al., 2006a; Gordon, Lewandowski, and Keiser, 1999). As a disability classification, SLD should only be associated with *significantly below-average achievement levels*. Special services may be beneficial for all students experiencing academic difficulties (including those who have average achievement levels), but the need for some type of educational intervention provides an inadequate reason for SLD identification. That is, the SLD category should not be made the convenient entry to special education for any and all students who might otherwise not receive special services.

In sum, the ability–achievement discrepancy criterion does not meet Keogh's (2005) criteria for determining the adequacy and utility of a diagnostic system. There is ample evidence to show that the discrepancy criterion does not capture the distinctiveness of SLD. At best, the discrepancy criterion may serve as a means of identifying underachievement when the ability measure is not attenuated by ability/processing deficiencies.

10.2 Response to Intervention

The RTI process is based on the concept of treatment validity whose goal is "to simultaneously inform, foster, and document the necessity for and effectiveness of special treatment" (Fuchs and Fuchs, 1998, pp. 204–205). The viability of an RTI model has been tested (e.g., Fletcher et al., 2002; McMaster, Fuchs, Fuchs, and Compton, 2005; Vaughn, Linan-Thompson, and Hickman, 2003), but the RTI model is far from complete (Mellard, Deshler, and Barth, 2004). To enhance the RTI process, a National Research Center on Learning Disabilities was established to conduct research on SLD identification and classification (Fuchs, Deshler, and Reschly, 2004).

In the context of special education, the RTI model is best viewed as a process aimed at prevention of significant reading difficulties (Kavale, Holdnack, and Mostert, 2005). However, as presently constituted, RTI appears to erroneously equate reading disability/difficulty (RD) and SLD. Almost all studies questioning the validity of discrepancy-based classifications have studied students with reading disability/difficulty, not other types of SLD (e.g.,

[2] For example, if one or more abilities/processes that make up the total test score on an intelligence battery is deficient (e.g., <85), then the total test score would be higher if those scores were removed from its calculation. The assumption is that the abilities/processes in which the student is deficient are responsible for the low achievement; see Flanagan et al. (2006b) for a comprehensive discussion.

Stanovich, 1991; Stuebing et al., 2001; Vellutino, Scanlon, and Lyon, 2000). Consequently, these investigations may influence decisions about "specific reading retardation" (Rutter and Yule, 1975), but they do not necessarily generalize to other types of SLD. The rationale that RD is the most common form of SLD (see Stanovich, 2005) fails to acknowledge that other types of SLD, such as mathematics disorder, can stand alone as a construct independent of RD (Kavale and Forness, 1995). Nevertheless, in the RTI model, students experiencing early reading difficulties are provided with increasingly frequent and intensive interventions; and if they continue to be "treatment resisters" (Torgeson, 2000), then they are deemed eligible for special education under the SLD designation. To date, the RTI process only confirms the presence of significant reading difficulties. The question of whether the student is RD or has another type of SLD remains.

Although one may have some justification for inferring RD from the RTI process, the SLD designation in the RTI model seems to be conferred by decree. As suggested by Kavale et al. (2005a, p. 12), "What is the basis for the SLD designation? In reality, there is none, unless there is some legerdemain whereby all [reading difficulties] magically transform... into SLD." With its lack of diagnostic validity, the RTI model is best viewed as a prereferral process (Pugach and Johnson, 1989). The prereferral process has, however, been marked by inconsistent implementation with problems in terminology, professional ownership, and practical matters (e.g., size of team, nature of problems addressed, extent of team involvement in intervention) (e.g., Buck, Polloway, Smith-Thomas, and Cook, 2003; Truscott, Cohen, Sams, Sanborn, and Frank, 2005). Notwithstanding, the real value of RTI lies in the prospect of providing a systematic and rigorous prereferral process (e.g., Fuchs, Fuchs, and Compton, 2004; Mellard, Byrd, Johnson, Tollefson, and Boesche, 2004).

When the RTI model deems a student eligible for special education services (even though SLD status remains unknown), it is because scientifically validated interventions did not result in an expected positive response. Such a finding suggests the presence of unique and idiosyncratic learning needs. However, the RTI model does not suggest the type of individualized instruction that should be provided next, precisely because the model does not contain a mechanism for identifying the presumptive cause of the student's learning needs. A student who does not demonstrate a positive response to scientifically validated interventions should not be placed in special education without essential diagnostic and instructional planning information. It is our contention that this information is best obtained from a comprehensive evaluation of cognitive abilities/processes, academic achievement, and psychosocial functioning (Flanagan et al., 2006b; Kavale et al., 2005). In the absence of such information, students who fail to respond to intervention will be educated no differently in special education classrooms than the hundreds of thousands of students who have been placed there based *solely* on a discrepancy between ability and achievement. This is because each model fails to provide a crucial element that is necessary for constructing *individualized* educational plans, information about students' specific cognitive ability/processing integrities and deficiencies and their relationship to academic skills. Whereas some operational definitions of SLD use an ability–achievement discrepancy as a foundation for SLD, or as a necessary but not sufficient condition for an SLD diagnosis (Kavale and Forness, 2000a, 2000b), the RTI process offers no direction for further diagnostic activities even with the tedious operationalization of unexpected underachievement in "hybrid models" combining low achievement and RTI (see Fletcher, Denton, and Francis, 2005).

By clustering all low-achieving (LA) students into a single group, the RTI model offers no means for differentiating among members to determine who can be designated SLD. Besides the presence or absence of underachievement, exclusionary criteria are often considered, but there is no justification for assuming those remaining are SLD. For example, IDEA guidelines exclude students with mental retardation (MR) from SLD classification. Without information from an intelligence test, how is it possible to determine if overall ability is below the requisite level of 70 (or perhaps 75) for MR classification? Although MR is specifically excluded from SLD consideration, the student with an IQ of 70 (or 75) to 85 (or 90) represents the "slow learner" for who there is increasing desire to provide special education services even though never a recognized special education category. The problem is that the slow learner is not an underachiever; achievement is at a level consonant with cognitive ability (Keogh, 1994). When underachievement is not documented, an RTI process that selects students solely on the basis of LA will likely include those whose academic problems are expected (“slow learners”).

The RTI model seems predicated on the assumption that those who fail to respond possess the same cognitive deficits regardless of IQ level. Although RTI is presently based on a limited conceptualization of reading (i.e., word decoding), it, nevertheless, remains important to identify cognitive strengths to facilitate better understanding of SLD and the best ways to develop intervention plans. In essence, the RTI model does not provide an answer to the question, “which cognitive abilities/processes are deficient and which ones remain intact?”

The SLD construct has long been associated with intra-individual differences. To understand an individual student’s array of strengths and weaknesses, a comprehensive cognitive assessment is the most efficient means to reveal cognitive integrities, as well as deficiencies. With the neurological bases for SLD supported (e.g., Galaburda, 2005; Kibby and Hynd, 2001), it becomes important to determine how specific cognitive deficits may be causally linked to specific academic deficits. Such an analysis describes the nature of SLD, which is not captured by simply describing achievement deficits that are not amenable to remedial efforts.

In sum, although a variety of RTI models are available (see Fuchs, Mock, Morgan, and Young, 2003), like the ability–achievement discrepancy models, none of the RTI models appears to meet all of Keogh’s criteria (homogeneity, reliability, validity) for determining the adequacy and utility of a diagnostic system. If the question is how to best capture the distinctiveness of SLD, then simply being nonresponsive to treatment does not appear sufficient. Although it is our contention that the RTI model cannot legitimately identify SLD, the process does serve to create a pool of at-risk students who may or may not have SLD.

10.3 Cognitive Ability/Processing Assessment

As stated above, cognitive ability/processing deficits define SLD: “The term ‘specific learning disability’ means a disorder in one or more of the basic psychological processes. . . .” Yet, cognitive ability/processing deficits have not been a primary identification criterion and have not been included in many states’ operational definitions of the federal definition. Consequently, there has been a longstanding disconnect between elements stipulated in the formal definition and the elements selected for inclusion in operational definitions which undermines valid scientific principles (Kavale and Forness, 2000a, 2000b). Cognitive ability/processing deficits represent the *essence* of SLD and, in a sense, make SLD what it is (Flanagan, 2003; Flanagan, Ortiz, Alfonso, and Mascolo, 2002, 2006b; Kavale and Forness, 1995). In other words, it is our belief that an SLD diagnosis cannot be made in the absence of well-documented processing deficits (along with other variables).

Early conceptualizations of SLD emphasized the role of perceptual-motor processes, but these were shown to lack sufficient reliability and validity (Coles, 1978; Mann, 1971). The subsequent downgrading of perceptual-motor processes was clearly seen in the decision to ensconce discrepancy as the primary operational indicator of SLD. Nevertheless, when asked the question “What shall we do with psychological processes?”, Torgesen (1979, p. 520) responded, “we should keep the concept of psychological processes alive. The notion of deficiencies in the processing activities required for learning is essential to the maintenance of concern with learning disabled children as a special subgroup within the general population of underachievers.” Torgesen’s response is consistent with that of many current researchers (e.g., Flanagan, 2003; Flanagan and Kaufman, 2004; Flanagan et al., 2006a, 2006b; Gregg, Coleman, and Knight, 2003; Kaufman, Lichtenberger, Fletcher-Janzen, and Kaufman, 2004; Kavale et al., 2005; Mather and Schrank, 2003; Naglieri, 2005). In fact, all current intelligence tests are far more differentiated than their predecessors. Each test includes multiple theoretically validated measures of broad and specific cognitive ability/processing constructs, thereby reflecting the importance of evaluating processing strengths and integrities, particularly for evaluation of SLD (Kaufman, Kaufman, Kaufman, and Kaufman, 2005; Kavale et al., 2005; Naglieri, 2005; Roid and Pomplun, 2005; Schrank, 2006).

In examining the relationship between auditory and visual perception and reading ability, Kavale and Forness (2000a) found a correlation of $r = 0.597$ between the ITPA-Sound Blending subtest and reading, indicating a 60% increase in accurately predicting reading ability. Presently, sound blending would be viewed in terms of a phonological processing deficit affecting reading ability (Stanovich, 1985). This hypothesis has been validated by findings showing that phonological processing deficits are a primary characteristic of students who fail to respond in the RTI model (Al-Otaiba and Fuchs, 2002).

Whereas phonological processing deficits may differentiate "dyslexic" and "garden-variety poor readers" (Stanovich, 1988), they represent a deficit associated with reading difficulties; the SLD status of the individual student still needs to be determined. Just like the studies that questioned the validity of discrepancy classifications of students with reading disability/difficulty, the focus on phonological processing and early reading suggests that conclusions may be valid for "specific reading disability/difficulty" but not SLD (Rutter and Yule, 1975). The continuing failure to differentiate reading disability/difficulty from other types of SLD leads to erroneous and misguided suggestions, like defining SLD solely in terms of phonological and orthographic processing deficits because they differentiate types of reading disability/difficulty that the discrepancy model presumably cannot (see Spear-Swerling and Sternberg, 1996). Similarly, Dean and Burns (2002) suggested that a processing component in SLD definitions does not differentiate students with SLD from low achievers but provides research support focusing almost exclusively on students with reading disability/difficulty. The confound between SLD and reading disability/difficulty must be eliminated if efforts to improve SLD identification are to be successful.

The emphasis on phonological processing in the RTI model may be misleading. First, Swanson, Trainin, Necoechea, and Hammill (2003), after examining the correlational evidence, concluded that the importance of phonological awareness and rapid naming in accounting for reading may be overstated (see also Vukovic and Siegel, 2006). Second, Nelson, Benner, and Gonzalez (2003) found nonresponsiveness to be associated with a number of other learner characteristics in addition to phonological processing. Third, beyond RD, Kavale and Nye (1991) demonstrated how a variety of processing deficits may contribute to SLD. Processes related to attention, memory, perception, metacognition, and motivation, among others, have been similarly associated with SLD and essentially define SLD status. Consequently, the presence of processing deficits needs to be confirmed by a comprehensive evaluation. We agree with Francis et al. (2005) that IQ and achievement scores are not sufficient for SLD identification. As such, it seems clear that information about specific cognitive abilities/processes is necessary to insure reliable and valid SLD identification and to provide insight regarding individual functioning.

In moving away from a strict "g" interpretation, a number of theories about the structure of cognitive abilities have been developed (see Flanagan, Genshaft, and Harrison, 1997; Flanagan and Harrison, 2005). Among the most comprehensive and empirically validated is the CHC theory of cognitive abilities, which is used for selecting, organizing, and interpreting tests of intelligence and cognitive abilities (Flanagan and Ortiz, 2001; Flanagan, Ortiz, and Alfonso, 2007) and was recently expanded to include tests of academic achievement (Flanagan et al., 2002, 2006b). The CHC model includes 10 broad cognitive abilities that subsume over 70 narrow abilities. For example, the Broad Stratum II ability of long-term storage and retrieval (*Glr*) is composed of 13 Narrow Stratum I abilities (e.g., meaningful memory, word fluency, originality/creativity). Other Broad Stratum II abilities include crystallized intelligence (*Gc*), fluid reasoning (*Gf*), short-term memory (*Gsm*), visual processing (*Gv*), auditory processing (*Ga*), processing speed (*Gs*), and decision speed/reaction time (*Gt*). These cognitive abilities represent "processes" and, as suggested by Carroll (1993, p. 10), "A cognitive task is one in which suitable processing of mental information is the major determinant of whether the task is successfully performed." Assessment of these broad and narrow CHC abilities/processes is thus useful for identifying specific cognitive processing deficits and providing insight into the nature of unique learning needs.

The CHC model also includes two "achievement" Broad Stratum II abilities: reading and writing (*Grw*) and quantitative knowledge (*Gq*). The *Grw* domain includes eight narrow Stratum I abilities (reading decoding, reading comprehension, verbal language comprehension, cloze ability, spelling ability, writing ability, english usage knowledge, reading speed) and the quantitative knowledge domain includes two (math knowledge and math achievement). These achievement domains are included in CHC theory because there is virtually no distinction made between *cognitive* ability and *academic* ability in the cognitive psychology literature. The difference between cognitive and academic abilities is partially related to the different types of learning (formal and experiential) involved in their development. Carroll (1993, p. 510) suggested that cognitive and academic abilities are on a continuum extending from "the most general abilities to the most specialized types of knowledges," with the latter developing as a function of more formal and direct instructional and educational experiences. Simply put, "Cognitive abilities are measures of achievements, and measures of achievements are just as surely measures of cognitive abilities" (Horn, 1988, p. 655).

In reviews of the relations between cognitive abilities/processes and reading, math, and written language achievement, Flanagan et al. (2002, 2006b) demonstrated the importance of specific or narrow CHC abilities in explaining and predicting academic achievement. That is, many broad and narrow CHC abilities/processes are directly linked to achievement. The CHC theoretical framework provides a common terminology and set of definitions that reduces the possibility of misinterpretation of findings. Additionally, the CHC model permits assessments to be individually matched to student needs which can then provide data more closely linked to intervention: "Evaluation of individuals with learning difficulties that are *theory focused* and grounded in current research are more psychometrically respectable and have more accountability than those that are *test-kit focused* or devoid of a firm grounding in contemporary theory and research" (Flanagan et al., 2002, p. 62, italics in original).

The evaluation of the specific abilities/processes that are most closely associated with referral concerns (e.g., reading difficulties, math difficulties) is often based on "cross-battery assessment (XBA)" (Flanagan and Ortiz, 2001; Flanagan et al., 2007) where testing proceeds by "crossing" batteries (i.e., the careful selection of tests needed to supplement standard battery information). Based on an operational definition provided by Kavale and Forness (2000a, 2000b), Flanagan et al. (2002, 2006b) defined SLD in terms of CHC theory and its research base. This definition is described below.

10.4 An Operational Definition of Learning Disability

Kavale and Forness (2000a, 2000b) published one of the first general operational definitions of SLD. Their model included several levels, each of which was a "necessary but not sufficient" condition for SLD. When all conditions were met, however, sufficient data existed to make the SLD diagnosis. This model was an important development because it provided the specificity necessary to allow SLD to be operationalized more reliably. A modified version of this definition was presented by Flanagan et al. (2002, 2006b). These researchers incorporated CHC theory into the definition, thereby allowing both theory and research to guide the SLD identification process. They also restructured the component levels of Kavale and Forness's operational definition to provide a better correspondence with the assessment and evaluation process (Flanagan et al., 2006a). Whereas their operational definition introduced the concept of *consistency between cognitive and academic deficits*, it still allowed for use of a discrepancy approach, but only after the consistency was documented. Like Kavale and Forness's definition, the definition provided by Flanagan and colleagues consists of different levels (see Figure 10.1). As will become evident, it is only when the criteria at each of the four levels are met that SLD can be diagnosed under this model.

Consistent with IDEA 2004 and its attendant regulations (34 CFR Parts 300, 301, and 304) we see the use of norm-referenced ability testing as only one method among many that may be used in the evaluation of SLD. We wish to emphasize that, prior to engaging in the use of norm-referenced ability testing, other important and significant data sources should have already been collected, preferably within the context of RTI and other prereferral activities, including results from informal testing, direct observation of behaviors, work samples, reports from people familiar with the student's difficulties, such as teachers or parents, information provided by the student, and so forth. The operational definition is used when RTI methods meet with little to no success.

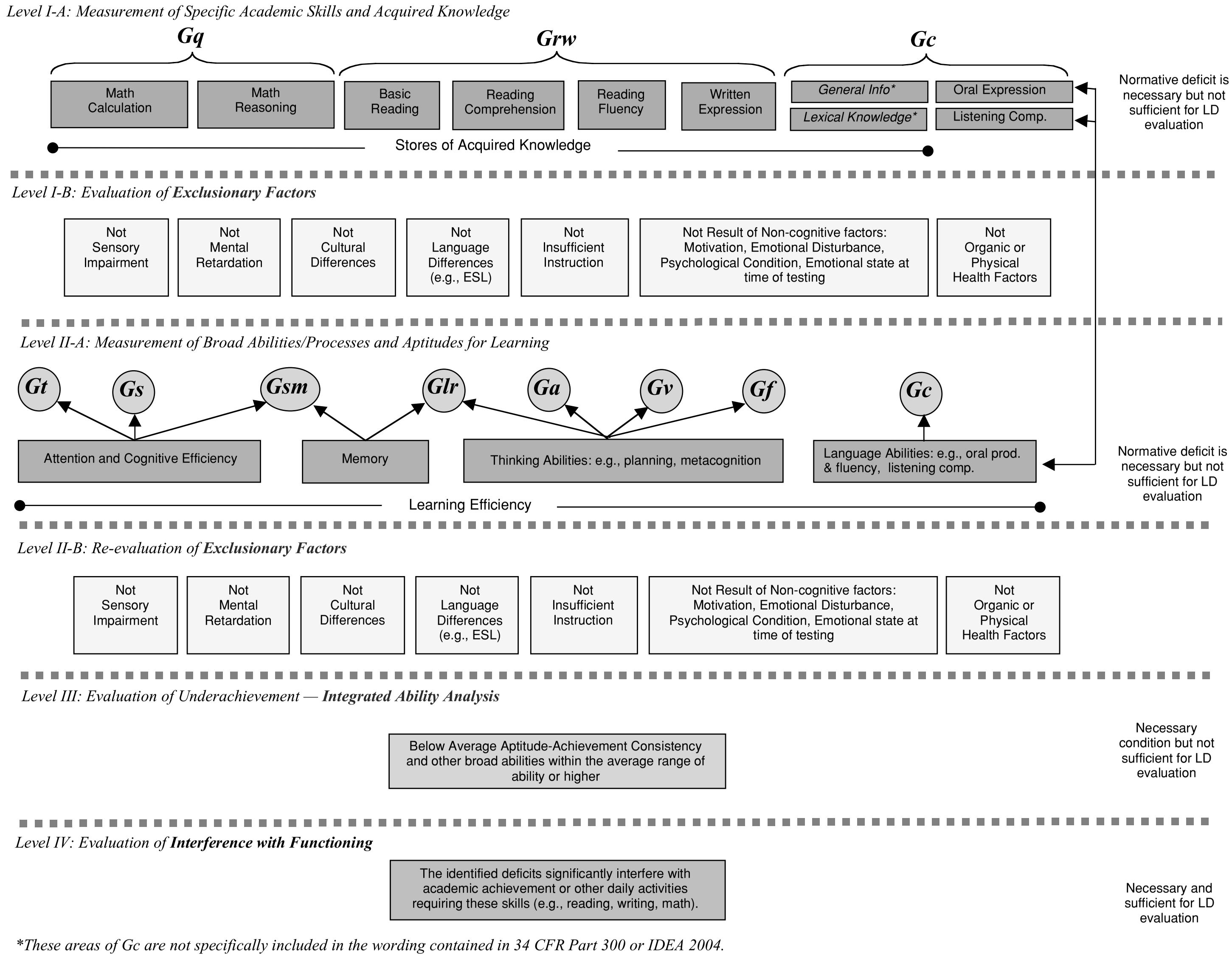

FIGURE 10.1. A definition of SLD incorporating CHC theory and research.
Note. This figure was developed by Flanagan, Ortiz, Alfonso, and Mascolo (2002) and was adapted with permission from John Wiley & Sons.

10.4.1 Level I-A: Measurement of Specific Academic Skills and Acquired Knowledge

Level I represents perhaps the most basic concept involved in SLD, that academic learning is somehow disrupted from its normal course on the basis of some type of internal dysfunction. Although the specific mechanism that inhibits learning is not directly observable, we can proceed on the assumption that it does manifest itself in observable phenomena, particularly in areas of academic achievement. Thus, the most logical and initial component of an operational definition of SLD should be establishing the fact that some type of *learning* dysfunction exists apart from reported low achievement (e.g., teacher reports). If no academic deficit or documented failure to respond to appropriate instruction can be found, whether through the use of standardized tests, RTI, or any other viable method, then the issue of SLD becomes moot because such dysfunction is a necessary component of the definition.

Assessment activities at Level I-A usually involve comprehensive assessment of the major areas of academic achievement (e.g., reading, writing, and math abilities). For convenience, as well as practical reasons, the academic abilities depicted in Figure 10.1 at this level in the hierarchy are organized according to the eight areas of achievement specified in IDEA 2004 (i.e., the regulation), math calculation, math problem solving, basic reading, reading comprehension, reading fluency, written expression, oral expression, and listening comprehension. The definitions of these academic domains are neither provided in IDEA 2004 nor based on any particular theoretical formulation. As such, they remain vague and nonspecific. Therefore, for theoretical and psychometric reasons, the academic abilities depicted at this level have also been organized according to the broad CHC abilities that encompass these achievement domains (i.e., *Gq*, *Grw*, and *Gc*). Generally speaking, Level I abilities tend to represent an individual's *stores of acquired knowledge.* These specific knowledge bases (i.e., *Gq*, *Grw*, and *Gc*) develop almost exclusively as a function of formal instruction, schooling, and educationally related experiences.

At Level I-A, the performance of the student is compared with the test's norm sample. The evaluator must answer the following question: Is performance relative to individuals of the same age in the general population within normal limits or higher? If yes, SLD is ruled out; if no, then further assessment is needed to rule out SLD. Note that the comparison is not based on performance within the individual, but rather performance of the individual contrasted with other individuals. Thus, person-relative discrepancies, no matter how large, are generally not useful as indicators of dysfunction unless one of the student's scores falls below the normative range (e.g., standard score of less than 85). Unless test data indicate a normative deficit in one or more areas of academic functioning, advancement to Level I-B analysis is unwarranted. If the criterion of a normative deficit in academic achievement is not met, then the evaluator should either reassess the sufficiency of the academic evaluation or reexamine the referral questions and concerns. For example, it is entirely possible that the test selected for initial evaluation simply failed to adequately assess the specific area of presumed dysfunction.

10.4.2 Level I-B: Evaluation of Exclusionary Factors

Level I-B involves evaluating whether the documented academic skill or knowledge deficit found through Level I-A analysis is *primarily* the result of factors other than an intrinsic cognitive dysfunction. Because the potential reasons for low performance are many and do not always reflect an actual manifestation of SLD, clinicians must be careful not to ascribe causal links to SLD prematurely and should develop reasonable hypotheses related to other potential causes. For example, cultural or language differences are factors that can adversely affect test performance and result in data that appear to suggest SLD. In addition, factors such as insufficient instruction, lack of motivation, emotional disturbance, performance anxiety, psychiatric disorders, sensory impairments, and medical conditions (e.g., hearing or vision problems), need to be ruled out as potential explanatory correlates to any deficiencies identified at Level I-A.

Noteworthy is the fact that the use of RTI methods prior to evaluation of specific abilities via norm-referenced ability testing can be used to assist in evaluating the data collected to this point. If RTI methods were employed prior to referral for testing, it is very likely that many of the plausible external reasons for the academic deficiency have already been ruled out (e.g., lack of sufficient instruction, lack of motivation, cultural and linguistic differences). Alternatively, some relevant and important exclusionary factors may not be uncovered until later in the assessment process. This is because it may not be possible to rule out certain conditions at this level, such as MR, which may necessitate Level II-A assessment (i.e., assessment of cognitive abilities/processes). When the conditions listed at Level I-B have been assessed, at least those that can be reliably evaluated and determined not to be the primary reason for the observed academic deficits, assessment may advance to Level II-A.

10.4.3 Level II-A: Measurement of Abilities/Processes and Aptitudes for Learning

Level II-A evaluation is similar to Level I-A evaluation, except that it focuses on cognitive ability/processes rather than on academic skills. In general, the process of assessment at Level II-A proceeds with the expectation that an individual will perform within normal limits (i.e., standard scores of 85 to 115, inclusive) in all or nearly all of the areas listed in this level in Figure 10.1. The questions that must be answered at this level are as follows: (1) Is performance on tests of cognitive ability or processing within normal limits relative to people of the same age in the general population? (2) If a deficit in cognitive ability/processing is found, is it empirically or logically related to the academic skill deficit? Of the more salient aspects involved in creating an operational definition of SLD, none is more central than the need to establish the potential presence of a *normative deficit* in a particular cognitive ability/process that is related to and is the presumptive cause of the observed academic deficit(s). This is because SLD is defined as a *disorder* in one or more psychological processes. Although the term "disorder" may be defined in numerous ways, it seems clear that this term is not synonymous with *average* ability. A disorder implies "dysfunction," "deficit," or "disability." Therefore, documenting a disorder should be based on population-relative comparisons.

The cognitive abilities depicted at this level in the evaluation hierarchy in Figure 10.1 are organized according to the broad abilities specified by CHC theory (i.e., *Gs*, *Gsm*, *Glr*, *Ga*, *Gv*, *Gf*, and *Gc*). These CHC abilities are organized further according to the processes they represent primarily from an information processing perspective, including attention and cognitive efficiency, memory, "thinking abilities," and language abilities (e.g., Dean and Woodcock, 1999; Woodcock, 1993). The latter category represents the collection of *Gc* narrow abilities that more accurately reflect processing skills as opposed to the abilities that represent stores of acquired knowledge that were included at Level I-A. Generally speaking, the abilities depicted at Level II-A provide valuable information about an individual's *learning efficiency*. Development of most of the cognitive abilities/processes represented at this level tend to be less dependent on formal classroom instruction and schooling as compared to the abilities presented at Level I-A (Carroll, 1993, 1997). Furthermore, specific or narrow abilities within many of the CHC areas listed in Level II-A may be combined to yield specific aptitudes for learning in different areas (e.g., reading, math, writing). These aptitudes are expected to be related to and consistent with academic outcomes. For example, deficiency in phonetic coding (a narrow *Ga* ability), naming facility (a narrow *Glr* ability), or working memory (a *Gsm* ability), or some combination thereof, may be used to explain a deficit in basic reading skill (when other factors have been ruled out; see Table 10.1). This is because these abilities/processes have been found to explain significant variance in basic reading skill (e.g., Fletcher et al., 2002). Moreover, deficiency in one or more of these cognitive abilities/processes is consistent with the "disorder in one or more of the basic psychological processes" terminology used in the federal definition of SLD.

Data generated at Level II-A, like the data generated at Level I-A, provide input for Level III analyses, should the process advance to the third level. The evaluator may progress to Level III when the following two criteria are met: (1) identification of a normative deficit in at least one area of cognitive ability/processing; and (2) identification of an empirical or logical link between low functioning in any identified area of cognitive ability or processing and a corresponding weakness in academic

TABLE 10.1. Summary of findings on relations between CHC abilities/processes and academic achievement.

CHC ability	Reading achievement	Math achievement	Writing achievement
Gf	Inductive (I) and general sequential reasoning (RG) abilities play a moderate role in reading comprehension.	**Inductive (I) and general sequential (RG) reasoning abilities are consistently very important at all ages.**	Inductive (I) and general sequential reasoning abilities are related to basic writing skills primarily during the elementary school years (e.g., 6 to 13) and consistently related to written expression at all ages.
Gc	**Language development (LD), lexical knowledge (VL), and listening ability (LS) are important at all ages. These abilities become increasingly more important with age.**	**Language development (LD), lexical knowledge (VL), and listening abilities (LS) are important at all ages. These abilities become increasingly more important with age.**	**Language development (LD), lexical knowledge (VL), and general information (K0) are important primarily after age 7. These abilities become increasingly more important with age.**
Gsm	Memory span (MS) is important especially when evaluated **within the context of working memory.**	Memory span (MS) is important especially when evaluated **within the context of working memory.**	**Memory span (MS) is important to writing, especially spelling skills, whereas working memory has shown relations with advanced writing skills (e.g., written expression).**
Gv	Orthographic processing	May be important primarily for higher level or advanced mathematics (e.g., geometry, calculus).	
Ga	**Phonetic coding (PC) or "phonological awareness/processing" is very important during the elementary school years.**		Phonetic coding (PC) or "phonological awareness/processing" is very important during the elementary school years for both basic writing skills and written expression (primarily before age 11).
Glr	**Naming facility (NA) or "rapid automatic naming" is very important during the elementary school years.** Associative memory (MA) may be somewhat important at select ages (e.g., age 6).		Naming facility (NA) or "rapid automatic naming" has demonstrated relations with written expression, primarily the fluency aspect of writing.
Gs	**Perceptual speed (P) is important during all school years, particularly the elementary school years.**	**Perceptual speed (P) is important during all school years, particularly the elementary school years.**	**Perceptual speed (P) is important during all school years for basic writing and related to all ages for written expression.**

Note: The absence of comments for a particular CHC ability and achievement area (e.g., *Ga* and mathematics) indicates that the research reviewed either did not report any significant relations between the respective CHC ability and the achievement area, or if significant findings were reported, they were weak and were for only a limited number of studies. Comments in bold represent the CHC abilities that showed the strongest and most consistent relations with the respective achievement domain. Information in this table was reproduced from McGrew and Flanagan (1998) and Flanagan, McGrew, and Ortiz (2000) with permission from Allyn and Bacon. All rights reserved.

performance (as identified in Level I-A analysis). The first criterion is necessary in order to establish the presence of a disorder in a psychological process. Low achievement performance, in the absence of cognitive deficiencies, does not meet criteria presented here as well as in other current conceptualizations of SLD, although it does meet criteria under RTI models. In addition, the cognitive deficiency must be normatively based, not person based. The so-called weaknesses derived from ipsative analysis (also called intra-individual analysis) are irrelevant, regardless of statistical significance, unless the "weakness" also falls within the normative weakness range (generally about one standard deviation or more below the mean of 100). The second criterion is necessary in order to establish a valid basis for linking the cognitive deficit with the academic deficit.

10.4.4 Level II-B: Reevaluation of Exclusionary Factors

Although the presence of a cognitive ability/processing deficit that is related to the academic deficit is fundamental to the operational definition of SLD described herein, these deficits must not be primarily the result of exclusionary factors. Hypotheses regarding reasonable explanations (particularly situation-specific factors, such as motivation and fatigue) for the observed cognitive deficit(s) must be rejected in order to conclude that the data represent an accurate and valid reflection of true ability. When all appropriate exclusionary factors have been evaluated and excluded as the primary reason for the observed cognitive deficits, the process may advance to Level III.

10.4.5 Level III: Evaluation of Underachievement

Advancement to Level III automatically implies that three necessary conditions for determination of SLD have been met: (1) one or more academic ability deficits have been identified; (2) one or more cognitive ability/processing deficits have been identified; and (3) the identified academic and cognitive deficits are related and have been determined not to be the primary result of exclusionary factors. What has not yet been determined, however, is whether the pattern of results supports the notion of underachievement in the manner that might be expected in cases of suspected SLD or whether the pattern of results may be better explained via alternative causes such as mild MR or other factors known to have an adverse effect on both academic and cognitive performance (e.g., sensory-motor handicaps, lack of English language proficiency). Thus, Level III involves evaluation of all data to verify (1) that the student possesses specific and related academic and cognitive deficits (e.g., an aptitude-achievement *consistency*) and (2) that these deficits exist within an otherwise *normal ability/processing* profile.

Given the historical predominance of the discrepancy model, evaluation of consistency may appear unusual at first. An aptitude score is comprised specifically of tests that are most directly relevant to the development and acquisition of specific academic skills, and, thus, is the best predictor of the corresponding achievement area. For example, an individual with low reading ability and isolated cognitive deficits in one or more areas (or aptitudes) related to reading achievement (e.g., phonological awareness, processing speed, short-term memory) will most likely demonstrate consistency between scores of reading aptitude and reading achievement. Likewise, a high reading aptitude score would predict high reading achievement (i.e., the two scores are more likely to be *consistent* with each other than to be discrepant).

Because consistency in scores that are within normal limits or even above would have already failed to demonstrate normative-based deficits, SLD determination at this level is concerned with scores that fall below the average range. A low aptitude score coupled with a low academic achievement score is insufficient, however, to meet our criterion for SLD unless it occurs within the context of an otherwise average or better pattern of functioning. Meeting these requirements involves evaluation of consistency between low aptitude and low achievement scores, as well as a pattern of results that demonstrates average or better functioning in other cognitive abilities/processes. Low aptitude scores across the board (i.e., all or nearly all cognitive abilities/processes in the deficient range) may be more suggestive of mild MR, a condition that would preclude determination of SLD under this definition (and most others). In the case of an individual with reading difficulties, it would be necessary to determine the level of performance or functioning in all cognitive areas, including those that are largely unrelated to reading. If the majority of these abilities are within normal limits relative to same-aged peers in the general population, then the practitioner can be reasonably confident that the consistency between reading aptitude deficits (e.g., below-average performance on cognitive abilities/processes related to reading, such as phonological processing and working memory) and academic deficits in reading represents underachievement.

10.4.6 Level IV: Evaluation of Interference with Functioning

When SLD determination reaches this point, criteria at the previous three levels have been met, thus supporting the presence of SLD. Further evaluation may seem unnecessary, but an operational definition of SLD based only on the previous criteria would be incomplete. One of the basic eligibility requirements contained in both the legal and clinical definitions for establishing SLD refers to whether the suspected learning disorder actually results in significant or substantial academic failure or other restrictions/limitations in daily life functioning. This final criterion reflects the need to take a broad survey of all collected data and the real-world manifestations of any presumed disability. In general, if the principles specified in Levels I through III have been followed and the criteria adhered to, then it is very likely that Level IV analysis serves only to support conclusions that have already been drawn up to this point. However, in cases where data may be equivocal, Level IV analysis becomes an important safety valve, ensuring that any representations of SLD suggested by the data are indeed manifest in observable impairments in one or more areas of functioning in real-life settings.

The advantage of the Flanagan et al. (2006b) operational definition lies in its integration of established notions about the nature of SLD with theories about the structure of cognitive abilities into "an inherently practical method for LD assessment that clearly specifies relationships between and among both cognitive and academic abilities, definitions of aptitude and global ability scores, and a recursive process that accommodates essential elements necessary for high-quality evaluation of learning difficulties" (p. 360).

10.5 Summary and Conclusion

It is well known that the ability–achievement discrepancy criterion is unreliable and invalid when used as the sole criterion for SLD identification and that its use has led to overidentification of this disability category in the special education population. Fortunately, there is a movement away from this method toward potentially more viable methods, with RTI being the most prominent.

The RTI model is part of an effort to (a) develop defensible methods of SLD identification, (b) develop and implement scientifically valid interventions, and (c) ensure that students with SLD benefit from school improvement and accountability efforts (Danielson, Doolittle, and Bradley, 2005). To date, the RTI model does not appear to meet all of Keogh's (2005) criteria (homogeneity, reliability, validity) for determining the adequacy and utility of a diagnostic system. At best, the RTI model identifies students who are at risk for reading failure, but the narrowly focused reading achievement problem, the single processing deficit, and the limited intervention options suggest that what is being identified is a far cry from SLD in any significant sense (Kavale, 2005). RTI has offered little for SLD identification except for the unwarranted presupposition that nonresponsiveness equates to SLD status. Although the RTI model cannot legitimately identify SLD at this time, the process does serve to create a pool of at-risk students who may or may not have SLD.

In its present form, the RTI model lacks reliability and validity as a diagnostic system for SLD. There can be little confidence in the SLD status of students identified through RTI because SLD determination is essentially by fiat: nonresponsive *ipso facto* SLD. If RTI is properly viewed as a systematic and rigorous prereferral activity that identifies *potential* SLD, then final determination of SLD status needs to be based on a comprehensive psychometric evaluation. When that evaluation is structured within a defensible operational definition of SLD supported by a validated theory of cognitive functioning, such as the one presented herein, decisions about who is and who is not SLD will be significantly enhanced. This is because a defensible operational definition of SLD includes all facets of the condition, including criteria for documenting a disorder in one or more basic psychological processes. By organizing a set of criteria that is consistent with IDEA 2004 and its attendant regulations, the probability of identifying SLD in a reliable and valid manner increases.

In conclusion, we believe that RTI and evaluation of cognitive abilities/processes are complementary (not competing) approaches, and the integration of the two may provide the most viable means of SLD identification to date. The operational definition presented here describes current attempts to integrate RTI methods and their scientific rigor with modern theory on the structure of cognitive and academic abilities/processes in a manner that may lead to better consistency in accepted notions of SLD. Future directions in SLD identification should focus on evaluating the SLD diagnostic system described in this chapter (i.e., the operational definition) following Keogh's criteria.

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