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INTEGRATION OF RESPONSE TO INTERVENTION AND NORM-REFERENCED TESTS IN LEARNING DISABILITY IDENTIFICATION: LEARNING FROM THE TOWER OF BABEL

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Significant limitations in research on learning disability (LD) have included failure to incorporate well-validated guiding theories, use of vague or nonspecific operational definitions, and lack of a systematic framework and common terminology for LD identification. Difficulties in communication among researchers continue to limit theoretical development and empirical advancement, and have lead to disagreement regarding best practices in identification. To this end, we propose an operational definition of LD that is grounded in contemporary psychometric theory and research on the relations between cognitive abilities/processes and academic outcomes. We demonstrate that response-to-intervention (RTI) and norm-referenced ability testing should not be viewed as mutually exclusive, but instead should be integrated within an operational definition of LD. Only when there exists a common set of definitions and terms, as is evident in operational definitions, can researchers and practitioners move toward the goal of better diagnosis and treatment of LD. © 2006 Wiley Periodicals, Inc.

According to a well-known Bible narrative, the *Tower of Babel* was a project undertaken by a united humanity. Their ultimate goal was to reach the heavens. To prevent the project from succeeding, God confused their common language so that each spoke a different language and dispersed them to different lands across the face of the Earth. As a result, they could no longer communicate with one another, and their work on the tower ceased.

This story is not unlike what we see today with respect to the identification and diagnosis of learning disability (LD). Understanding LD and how to diagnose it does not, of course, represent the same lofty goal as that held by the Tower of Babel's builders. Nevertheless, the task of delineating an LD definition and a corresponding set of diagnostic criteria suffers from the very same problem—failure to use a common language and an inability to communicate within and across disciplines using a common set of terms that mean the same thing to all who use them. Despite sharing similar ideas and objectives, practitioners, researchers, and scholars who have a common interest in LD also have a long history of using definitions and diagnostic criteria that are ambiguous. This ambiguity in the LD literature and related fields (e.g., school, clinical, and educational psychology; special education) has made it difficult to know whether debates over LD definitions and diagnostic criteria involve substantive or semantic differences. Whereas individuals united by a common language may be able to solve most problems, there is little hope in understanding LD if there is no common language to join together those who study it and seek to define it better.

There are many ways in which the lack of cohesion and focus in LD research is illustrated. For example, one of the most ubiquitous criticisms of the LD literature over the past few decades is that LD samples are heterogeneous, primarily because they were derived using a variety of diagnostic criteria. Moreover, in many studies that include LD samples, the criteria that were used

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to identify LD are not mentioned. Because LD is defined in numerous ways and identified using varying methods and criteria across studies, the generalizability of results is often called into question. Consequently, the literature on LD is replete with discussions and debates that are more about the ambiguity and inconsistency regarding its nature and definition than they are about new knowledge that might ultimately advance our understanding of these disorders.

The recent debate regarding the use of Response to Intervention (RTI) in lieu of data yielded from norm-referenced ability testing also exemplifies the consequences of not having developed a common language for understanding LD. These two approaches to understanding LD have often been regarded and promoted as mutually exclusive. We do not believe this to be true. It is our contention that the main factor that has precluded a better understanding of how these two approaches might complement one another and how they might be united by a common language lies in the lack of an operational definition of LD. Only through widespread use of this type of definition can the derivation of scientific knowledge about LD proceed more efficiently and productively.

The purpose of this article is to promote practices in the evaluation and diagnosis of LD that are guided by clear theoretical specifications and that are empirically supported. To this end, we offer an operational definition that includes the most salient components of LD as well as specific diagnostic criteria—a definition that is grounded in contemporary psychometric theory and decades of research on the relations between cognitive abilities/processes and academic outcomes, including research on the most consistently identified "markers" of learning success/failure. It is our belief that if such a definition were used regularly, not only would practitioners, researchers, and trainers across a wide range of disciplines be able to converse with one another about the nature of LD but our understanding of it would advance significantly.

Common Components of LD

Although researchers over the years have used proprietary language and a host of different methodologies, criteria, and operational definitions, some commonalities across LD studies and conceptualizations do exist. In general, the following represent common components of the definition of LD and criteria used to diagnose it: (a) history of academic difficulties, (b) use of prereferral interventions, (c) an identified academic deficit(s), (d) an identified cognitive ability/processing deficit(s), (e) intact cognitive abilities/processes in areas not strongly related to the academic deficit(s), (f) underachievement, (g) evaluation of exclusionary factors, and (h) evidence of functional impairment. Each of these components is defined briefly next.

History of Academic Difficulties

Specific learning disability is a developmental disorder. Therefore, it is expected that students who show manifestations of underlying learning difficulties in later grades (e.g., middle school, high school), that substantially impact current performance in one or more academic domains, should also have displayed some history of learning problems, assuming the current condition did not result from recent trauma (e.g., head injury).

Use of Prereferral Intervention

Many practitioners involved in LD identification have not systematically and consistently employed prereferral interventions. This may be because they do not involve or require norm-referenced ability testing and, therefore, do not seem directly relevant to LD identification. It is clear, however, that the use of prereferral interventions is an important component of the LD identification process because it serves to eliminate referrals for suspected LD that can be reasonably explained by lack of appropriate instruction, poor motivation, and so forth. Some of the major

problems with prereferral interventions are that they are not always based on empirical evidence and that they are rarely monitored in a manner that allows for evaluation of their effectiveness. Because RTI methods address these limitations, they will likely prove to be of great value in a comprehensive approach to understanding learning difficulties and ultimately in the process of identifying LD.

An Identified Academic Deficit

Learning disability, by definition, involves deficits in learning, particularly within the critical developmental period in early elementary school when academic skills are first taught and acquired. Thus, virtually all definitions and conceptualizations of LD incorporate reference to the identification of some type of deficit in one or more areas of academic functioning; however, there are significant differences in the manner in which such deficits are determined, and in some cases, no criteria are provided.

An Identified Cognitive Ability/Processing Deficit

There has been considerable debate recently regarding the relevance of identifying cognitive ability/processing deficits in the identification of LD. Too often, processing is thought of as comprising only a limited set of mental functions such as attention or sensorimotor ability. When viewed from such a perspective, there may well be little need to include evaluation of such processes in attempts to identify LD, as recently suggested by Dombrowski, Kamphaus, and Reynolds (2004) because there seems to be no logical relationship between a given process and a given academic skill. But such views tend to be atheoretical in nature, and as such, fail to account for and appreciate the role each may have in the development or acquisition of basic academic skills and knowledge. For example, both cognitive abilities and processes can be defined within the context of a well-validated, comprehensive, and modern theory of the structure of cognitive abilities [e.g., Cattell-Horn-Carroll (CHC) theory]. When so conceptualized, cognitive abilities/processes are important to LD identification because CHC theory and its expansive research base specifies the relations between cognitive abilities/processes and academic abilities (Flanagan, Ortiz, Alfonso, & Mascolo, 2006). The past decade has been characterized by a burgeoning body of research that demonstrates significant relations between various abilities, processes, and academic skills. Much of that research has revolved around the empirical link between auditory processing and the acquisition of basic reading skills, between fluid intelligence and mathematical ability, and between processing speed and the development of fluency in academic skills (Flanagan & Ortiz, 2001; Flanagan et al., 2006; Horn & Blankson, 2005; Horn & Noll, 1997).

Table 1 provides a summary of over two decades of research on the relations between cognitive abilities/processes and reading achievement. While it is beyond the scope of this article to discuss these findings in detail, a perusal of this table makes it clear that numerous cognitive abilities/processes are involved in reading. Therefore, if a student has difficulty in reading and fails to respond to evidence-based reading interventions, identification of the specific abilities/processes that likely impeded the expected response would have significant implications for further instructional planning as well as the development of alternative educational strategies and interventions. Flanagan, et al. (2002, 2006) also have summarized research on the relations between cognitive abilities/processes and other academic outcomes, namely math and written language achievement. Indeed, this research gives meaning to the most salient component of the federal definition of LD (IDEA, 2004)—that is, *a disorder in one or more of the basic psychological processes*.

Table 1
Summary of Relations Between CHC Abilities and Reading Achievement

CHC ability	Reading achievement
Gf	Inductive (I) and general sequential reasoning (RG) abilities play a moderate role in reading comprehension.
Gc	**Language development (LD), lexical knowledge (VL), and listening ability (LS) are important at all ages. These abilities become increasingly more important with age.**
Gsm	Memory span (MS) is important especially when evaluated **within the context of working memory.**
Gv	Orthographic processing.
Ga	**Phonetic coding (PC) or "phonological awareness/processing" is very important during the elementary-school years.**
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).
Gs	**Perceptual speed (P) abilities are important during all school years, particularly the elementary-school years.**

Note. Comments in bold represent the CHC abilities that showed the strongest and most consistent relations with reading achievement.

Intact Cognitive Abilities/Processes Not Related to the Academic Deficit

Apart from the identification of an academic deficit or deficits, identification of intact cognitive abilities/processes that are not related (or not strongly related) to the academic deficit represents another important component of LD diagnosis. The basic notion of this component of LD is that the individual displays relatively normal functioning in most cognitive areas and, therefore, has circumscribed deficits in cognitive areas that are specifically and strongly related to the academic area(s) of deficiency—a condition we describe as *below average cognitive and academic consistency within an otherwise normal ability profile* (Flanagan et al., 2006). Individuals with global cognitive deficits might be viewed as having mental retardation or another severe developmental disability, but not LD. The potential difficulty in documenting this component of LD involves differentiating circumscribed deficits from those that are more global in nature. Nevertheless, there is ample agreement that an individual with LD does not have deficits in all areas of cognitive functioning.

Underachievement

This component of LD is related to the previous one; however, underachievement has typically been documented through evidence of a significant *discrepancy* between ability (usually a global score from an IQ test) and achievement (a score from an academic skills test) as opposed to a below average cognitive ability/processing-achievement *consistency* within an otherwise normal ability profile (described earlier). To operationalize underachievement, researchers resorted to an apparent shortcut that utilized IQ as an infallible predictor of an individual's expected level of achievement (or academic "potential"). The idea was to demonstrate underachievement by comparing "potential" achievement with "actual" achievement. The main problems with discrepancy approaches lie in the fact that IQ is a good predictor of general achievement only, and is frequently attenuated by the very abilities that comprise it and that are responsible for the low achievement. Thus, it resulted in a "wait to fail" approach to evaluation. The elimination of severe discrepancy from IDEA 2004 was not surprising given the abundance of evidence that has accumulated to discredit it (e.g., Badian, 1999; Finlan, 1992; Flanagan & Ortiz, 2001; Fletcher

et al., 1992; Fletcher et al., 1998; Gaskill & Brantley, 1996; Heath & Kush, 1991; Kavale & Forness, 2000; Meyer, 2000; Reynolds, 1990; Ross, 1992; Siegel, 1999; Stanovich, 1991, 2005; Stuebing et al., 2002).

Evaluation of Exclusionary Factors

Both the scientific and legal prescriptions for identification of LD have included references to the evaluation of so-called exclusionary factors. This component is intended to ensure that an academic deficit is not due to LD but rather to other factors such as cultural differences, linguistic differences (i.e., limited English proficiency), economic disadvantage, emotional or psychological disturbances, lack of motivation, fatigue, poor or ineffective instruction, and so forth. In essence, when the cause of the individual's observed academic or cognitive deficits can be ascribed *primarily* to any of these influences, then a diagnosis of LD would be unwarranted.

Evidence of Functional Impairment

This component of LD stems in part from legal statutes and precedent that have established the need for evidence of functional impairment in one or more activities of daily life, including learning. The recent reauthorization of IDEA defines this component primarily as an adverse effect on educational performance (which is not necessarily limited to academic skill development). Because this component involves aspects of legal interpretation that cannot be resolved easily, it remains somewhat controversial and is not embraced by all researchers in the area of LD. Nevertheless, if evidence is found for the conditions specified in the components of LD discussed previously, then evidence of a functional impairment may be nothing more than a *fait accompli*. Irrespective of how such impairment may be defined, it seems clear that it is an important component that practitioners should examine in the process of LD identification.

It may be apparent that the earlier discussion does not include specific references to RTI as one of the more salient components of LD identification. Despite the fact that the term (not necessarily the concept of) "RTI" is new to many, it is similar to the *prereferral interventions* component of LD identification and has generally replaced this terminology. It is our contention that RTI, unlike the many typical prereferral interventions, provides a rigorous and systematic approach that complements norm-referenced ability testing in the LD identification process. We believe that current conceptualizations of LD should incorporate both RTI and norm-referenced ability testing, and that when they are used together, LD may be identified more reliably and validly.

What Components of LD Are Included in Recent Conceptualizations?

Over the past few years, several researchers have offered operational definitions of LD (e.g., Kavale & Forness, 2000), specified diagnostic criteria for LD (Dombrowski et al., 2004; Mather & Gregg, 2006), or provided a framework that includes both an operational definition and specific diagnostic criteria (Flanagan et al., 2002, 2006). Table 2 provides a description of four LD conceptualizations, one of which has been revised recently and, therefore, is listed twice in the table (i.e., Flanagan et al., 2002, 2006). These conceptualizations are described in terms of their inclusion of the eight common components of LD.

A review of Table 2 shows that all LD conceptualizations include an *academic deficit* and evaluation of *exclusionary factors* as important components; however, variability exists in the criteria specified for identifying an academic deficit and for ruling out factors other than LD that may explain an academic deficit. Most conceptualizations of LD include a *history of academic difficulties*, particularly when the diagnosis is made in late childhood, adolescence, or adulthood. Four of the five conceptualizations included *underachievement*, a *cognitive ability/processing* deficit, or both. Again, the criteria used to evaluate these LD components varied. Less commonly

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Table 2
Common Components Included in Recent Conceptualizations of LD

Component of LD	Kavale & Forness (2000)	Flanagan, Ortiz, Alfonso, & Mascolo (2002)	Dombrowski, Kamphaus, & Reynolds (2004)	Mather & Gregg (2006)	Flanagan, Ortiz, Alfonso, & Mascolo (2006)
History of academic difficulties	—	✓	✓	✓	✓
criterion specified	—	Used to document functional impairment	Necessary when diagnosis is made after age 18 years	May be used to document limitation	Used to document functional impairment
Prereferral intervention	—	✓	✓	✓	✓
criterion specified	—	—	—	RTI may be used to rule out lack of appropriate instruction as cause of observed academic limitation	Empirically supported interventions following RTI methods
Academic deficit	✓	✓	✓	✓	✓
criterion specified	—	Performance outside and below normal limits (i.e., <85; focus is on the seven areas of achievement listed in 34 C.F.R. Part 300)	Performance more than 1 *SD* below the mean of 100 (i.e., <85)	Functional limitation based on intra-individual differences, not necessarily normative weaknesses	Performance generally outside and below normal limits (Focus is on the eight areas of achievement listed in 34 C.F.R. Part 300.)
Cognitive ability/process deficit	✓	✓	—	✓	✓
criterion specified	—	Performance outside and below normal limits (i.e., <85; focus is on the broad and narrow/specific CHC abilities that are empirically related to area of academic deficit)	Attention, auditory processing, and sensorimotor development (among others) are considered explanatory	Cognitive and linguistic difficulties that are correlated with observed academic limitations	Performance generally outside and below normal limits (Focus is on the broad and narrow/specific CHC abilities that are empirically related to area of academic deficit.)

Intact (average/normal limits) cognitive abilities/processes in areas not strongly related to academic deficit	✓	✓	—	—	✓
criterion specified	—	Performance within normal limits or higher (Focus is on the broad and narrow/ specific CHC abilities that are less related to area of academic deficit.)	—	—	Performance within normal limits or higher (Focus is on the broad and narrow/ specific CHC abilities that are less related to area of academic deficit.)
Underachievement	✓	✓	✓	—	✓
criterion specified	Ability–Achievement Discrepancy	Below Average Aptitude–Achievement Consistency and other abilities within normal limits or higher	Criteria same as above (i.e., <85); called developmental learning delay or developmental academic underachievement	—	Below Average Aptitude–Achievement Consistency and other abilities within normal limits or higher
Exclusionary factors	✓	✓	✓	✓	✓
criterion specified	—	Integration of multiple data sources and clinical judgment	Restricted to not MR, blindness, deafness, etc. Factors such as culture, language, economic are considered explanatory	Rule out factors such as MR and lack of opportunity for observed limitation using multiple sources of data (e.g., RTI, standardized or Curriculum-Based Measurements)	Integration of multiple data sources and clinical judgment
Functional impairment	—	✓	✓	—	✓
criterion specified	—	Based on current functioning and development data (e.g., prior evaluations, report cards) and history of academic difficulties	Based on either classroom grades, curriculum-based assessment, or teacher ratings of academic performance	—	Based on current functioning and development data (e.g., prior evaluations, report cards) and history of academic difficulties

included across conceptualizations were the LD components of *intact cognitive abilities/processes* and *functional impairment*. Intact abilities were defined either as a global IQ in the average range or better (Kavale & Forness, 2000) or performance in cognitive abilities/processes, not strongly related to the academic deficit, within normal limits (Standard Score = 85–115, inclusive) or better (Flanagan et al., 2002, 2006). Of the three LD conceptualizations that included a functional impairment as a component, only Dombrowski et al. (2004) specified criteria for establishing this condition (e.g., based on classroom grades, teacher ratings). Finally, *prereferral interventions* were considered an important component to LD identification in four of the five conceptualizations. Not surprisingly, however, within the context of the prereferral intervention component, only the most recent conceptualizations mentioned RTI specifically (i.e., Flanagan et al., 2006; Mather & Gregg, 2006).

The information included in Table 2 demonstrates that although there may be general agreement with regard to the essential components of LD, very little agreement exists with regard to the definition of and criteria specified for each component. In an attempt to move toward a resolution of this "Tower of Babel," we offer an operational definition that includes guidelines and criteria for evaluating all common components of LD and that accommodates RTI. Furthermore, this definition is most relevant to the LD identification process when appropriately designed interventions have been implemented and monitored but have failed to produce the desired outcome. It is precisely as a result of this finding that we believe norm-referenced ability testing, along with other data sources, can assist in determining whether the failure to respond to interventions is the result of a disorder in a basic psychological process. At this point in a student's education, knowledge of the specific nature of the cognitive ability/processing strengths and weaknesses may be the only way to inform further intervention planning. The compatibility of RTI and norm-referenced ability testing in the LD identification process is discussed next.

RTI and Norm-Referenced Ability Testing

RTI methods are procedures that should rightly precede the use of norm-referenced ability testing in LD evaluations. RTI provides practitioners with the means to answer an important question that is crucial to the diagnosis of LD: Are the child's learning difficulties related to poor or ineffective instruction? When students are given an opportunity to demonstrate what they have learned following explicit and appropriate instruction, authentic and accurate estimates of current academic functioning may be established regardless of whether data from standardized tests of achievement are available.

Notwithstanding the benefits of RTI, use of these methods creates an inherent dilemma: Do you assume the child has LD and therefore classify him or her as having LD and make a recommendation for placement in special education? Or do you assume the child may have LD and conduct a thorough evaluation of cognitive abilities/processes to determine underlying strengths and limitations? We believe the former assumption is premature and may actually result in misdiagnosis as well as prevent the child from receiving services that are most appropriate for his or her unique learning needs. This is because the child has presumably been exposed to the best available intervention and did not respond as expected. Therefore, it is difficult to imagine that special education could develop alternative interventions and instructional strategies in the absence of any additional information—indeed, information that may readily lead to an alternative method or approach to instruction. Herein lies the problem with an RTI-only perspective (for further discussion, see Flanagan et al., 2006). The latter assumption appears more reasonable because it has the potential to uncover information that may lead to a more definitive conclusion regarding whether the child has LD. Furthermore, this additional information may offer insight into how to modify the child's environment to more effectively facilitate learning. Despite the potential benefit

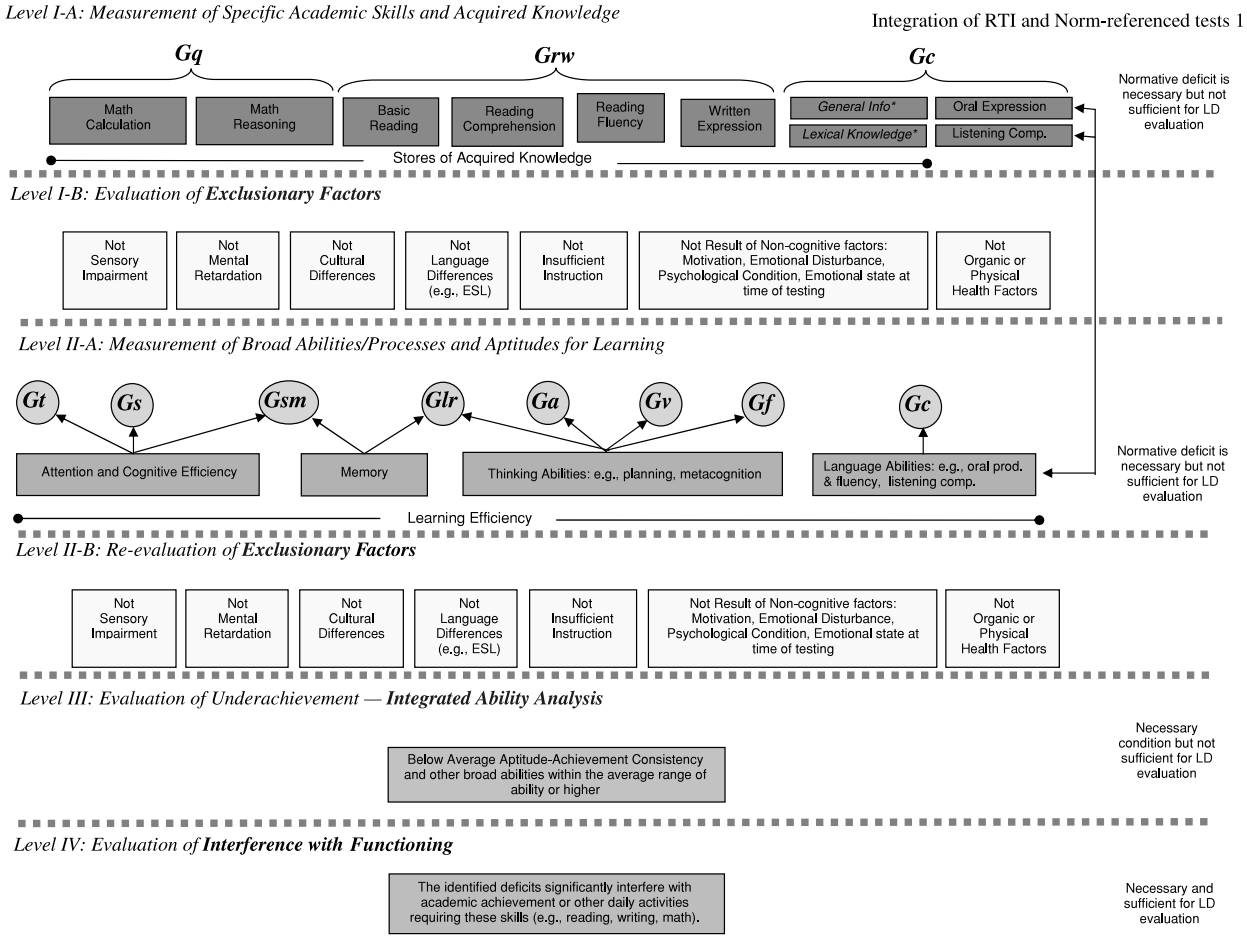
of norm-referenced ability testing for nonresponders, the use of standardized tests, particularly intelligence tests, has come under attack in the LD literature in recent years.

Opponents of cognitive testing for use in the LD determination process have decried the use of IQ tests and have portrayed them as being irrelevant to the process (Badian, 1999; Finlan, 1992; Fletcher et al., 1992; Fletcher et al., 1998; Gaskill & Brantley, 1996; Heath & Kush, 1991; Meyer, 2000; Reynolds, 1990; Ross, 1992; Siegel, 1999; Stanovich, 1991). But many of these critics have painted cognitive testing with a single brush as if all cognitive tests were designed merely to provide the ubiquitous IQ or measure of general intellectual ability. To the contrary, developments within the past two decades have seen tremendous advancements in test development, including a long-overdue alignment with current intellectual theory (Carroll, 1998; Flanagan & Harrison, 2005; Flanagan & Kaufman, 2004; Flanagan, McGrew, & Ortiz, 2000; Flanagan & Ortiz, 2001; Kaufman, 2000; McGrew, 2005). Current intelligence tests provide reliable and valid measures of a broader range of cognitive abilities than ever before. Combined with the rapidly growing body of research demonstrating the significant relationships between cognitive abilities/processes and academic achievement, the capacity to reliably assess functioning in specific cognitive areas (e.g., visual processing, auditory processing, short-term memory, processing speed, long-term storage and retrieval, etc.) is an important development, but has yet to significantly influence researchers, scholars, and special educators in the field of LD. It may be that certain interventions and instructional modifications that are implemented in attempts to improve a student's learning are ineffective precisely because the student has some type of disorder in a basic psychological process that inhibits learning through the means used. Armed with the information provided by intelligence tests that measure an individual's specific cognitive abilities/processes, special educators may now be in a position to develop alternative interventions because a better understanding of the individual's strengths and deficiencies has been achieved. Without knowledge regarding the nature of a student's presumed LD, educators would otherwise be relegated to providing additional instruction and modification without any guidance on what might prove to be more effective.

It is in this spirit that we offer our operational definition. Consistent with IDEA 2004 and its attendant regulations (U.S. Department of Education, 34 C.F.R. §§ 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 LD. We wish to emphasize that prior to engaging in the use of norm-referenced ability testing, other important and significant data sources already should have 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 (e.g., teachers or parents), information provided by the student, and so forth. The diagnosis of LD always should be based on multiple, corroborating sources of information. Taken together, the collected data must provide evidence to indicate that the student's learning and progress have been carefully examined, adequately monitored, and well documented. In general, only after the scope and nature of an individual's learning difficulties have been systematically evaluated and found not to be attributable to exclusionary factors, notably ineffective or inappropriate instruction, should practitioners seek to engage in norm-referenced ability testing. Thereafter, the collected data should continue to inform decisions made at each step of the process. The remainder of this article describes the various levels of our operational definition, which is depicted in Figure 1.

An Operational Definition of LD

As noted in the previous discussion, Kavale and Forness (2000) published what may have been the first attempt at an operational definition of LD. Their model specified several levels, each



*These areas of Gc are not specifically included in the wording contained in 34 CFR Part 300 or IDEA 2004.

FIGURE 1. Levels of our operational definition of learning disabilities.

of which was a "necessary but not sufficient" condition for identifying LD. Once all conditions were met in the definition, sufficient information and data existed to make the diagnosis. This model represented an important development in that it provided the kind of specificity that might allow LD to be operationalized in a consistent manner by researchers. A modified version of this definition next appeared in Flanagan and colleagues (2002), where the introduction of modern intelligence theory (i.e., CHC theory) provided a theoretical and empirically supported grounding of LD. In addition, the order of the component levels were restructured to provide a better correspondence with the assessment and evaluation process (Flanagan et al., 2002). Although this version of their operational definition also 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. Recently, Flanagan and colleagues (2006) introduced an updated version of their model, which includes additional refinements to the process of operationalizing LD. Of particular note is the absence of ability–achievement discrepancy and the placement of RTI into the operational definition. It is this model that is described in the following section.

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

Level I represents perhaps the most basic concept involved in learning disability—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 LD 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 LD becomes moot because such dysfunction is a necessary component of the definition. As will become evident, it is only when the criteria at each of the four levels of the operational definition are met that we believe practitioners can be confident that LD has been determined reliably.

Norm-referenced ability testing is a common, reliable, and valid method for determining whether the criteria at most levels of our operational definition are met. We consider the average range to be ± 1 *SD*, or between the 16th and 84th percentile ranks inclusive. Thus, when tests are used, academic deficits will generally be those that fall below the 16th percentile rank. Provision of a specific normative (or population-relative) cutoff or range for identifying below average functioning when using RTI methods is not feasible. This is because performance is compared to that of age and grade peers on classroom baseline measures.

Assessment activities at Level I-A will 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 1 at this level in the hierarchy are organized according to the eight areas of achievement specified in 34 C.F.R. § 300.309 that accompany IDEA 2004—namely, math calculation, math problem solving, basic reading, reading comprehension, reading fluency, written expression, oral expression, and listening comprehension. We have noted already that 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 also have 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. *Gc* tends to be somewhat of an exception to this rule. The abilities found under *Gc* include not only examples of repositories of learned material (e.g., lexical knowledge, general information, etc.) but also abilities that reflect the processing of information, such as oral production and fluency and listening comprehension. Consequently, we have chosen to make a slight distinction between these narrow abilities as represented under *Gc* in Level II-A (see Figure 1) and at Level I-A. It seems reasonable that the *Gc* abilities representing the stores of acquired knowledge will be those that are of main interest at Level I-A whereas any assessment that progresses to Level II-A will likely focus more on the process-oriented abilities. The dual nature of *Gc* in this respect is illustrated by the two-way arrows that link *Gc* (and its narrow abilities) at Level I-A and Level II-A in Figure 1.

Evaluation of LD should be driven by presumptions of normal functioning rather than by preconceptions of dysfunction. That is, it is important to assume that an individual does not have a learning disability, prior to evaluating any data, to prevent confirmatory bias (Sandoval, 1998). *Confirmatory bias* is the tendency to look only for data that support a preconception and to ignore data that tend to refute it. Beginning with the presumption of deficit or disability increases the chances that one will be identified. Therefore, we believe that the presumption of normal functioning is more appropriate and equitable for the examinee. Furthermore, the assumption of normal functioning must remain true unless and until the data clearly demonstrate otherwise. With respect to standardized test data, this means that in the absence of any gross physiological trauma or developmental dysfunction, and given a history of appropriate instruction and opportunity to learn, it is expected that an individual receiving LD assessment will perform generally within normal limits on tests of academic achievement (i.e., standard scores = 85–115, inclusive). This remains true for any and all areas depicted at Level I-A in Figure 1 that may have been evaluated.

At Level I-A, the performance of the student is compared to 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, the null hypothesis is retained; if no, the null hypothesis is rejected. 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 (i.e., generally, standard score <85). Unless test data clearly point to a potential normative deficit in one or more areas of academic functioning, advancement to Level I-B analysis is largely unwarranted. If the criterion of a normative deficit in academic achievement is not met, then the evaluator should either re-assess 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.

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 LD, clinicians must be careful not to ascribe causal links to LD 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 LD. 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.

If any exclusionary factors are identified and judged to be the primary cause of the academic skill deficiency, then the criterion at this level is not met, and it is therefore presumed that the student is not LD; however, note that certain exclusionary factors may be present and may be judged to contribute to the academic deficiency. Certainly, individuals who have vision problems, chronic illnesses, limited-English proficiency, and so forth also can be LD. Evaluation at this level is not intended to rule in LD, but rather to specifically rule out other possible explanations apart from LD. When no exclusionary factors are judged to be the primary cause of the academic deficit, even though they may be contributing to the deficit, then the criterion at this level is met and the evaluation proceeds to the next level. 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 already have been ruled out (e.g., lack of sufficient instruction, lack of motivation, cultural and linguistic differences, etc.). Alternatively, some relevant and important exclusionary factors may not be uncovered until much later in the assessment process because evaluation of exclusionary factors tends to be a recursive activity, occurring throughout the entire process of evaluation. In other words, as the evaluation of learning difficulties unfolds, the practitioner continually tests and retests hypotheses regarding the primary correlates to the manifest academic deficiencies. New data often lead to new hypotheses. In addition, it may not be possible to rule out certain conditions at this level, such as mental retardation, which may necessitate Level II-A assessment (i.e., assessment of cognitive abilities/processes). Thus, the process of ruling out exclusionary factors that contribute significantly to poor academic achievement is perhaps best conceptualized as beginning early in the evaluation process and continuing through the final level of analysis as may be necessary and appropriate. 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.

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

Level II-A evaluation is similar to Level I-A evaluation except that it focuses on cognitive ability/processing 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 = 85–115, inclusive) in all or nearly all of the areas listed in this level in Figure 1. The questions that must be answered at this level are: (a) Is performance on tests of cognitive ability or processing within normal limits relative to people of the same age in the general population? (b) 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 LD, 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 condition historically has been poorly defined and remains vague, possibly due to a failure to use theory and its evidential base to guide practice. Clinicians have long understood the need to identify some sort of cognitive dysfunction as an explanatory mechanism for deficient academic performance. Yet, there has been little, if any, theoretical specification to guide or support the myriad (often illogical) assumptions that have been made. Thus, to arrive at an effective operational definition of LD, theory must play a significant role.

The cognitive abilities depicted at this level in the evaluation hierarchy in Figure 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 & 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. 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 1) because these abilities/processes have been found to explain significant variance in basic reading skill. 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 IDEA 2004.

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: (a) identification of a normative deficit in at least one area of cognitive ability/processing and (b) identification of an empirical or logical link between low functioning in any identified area of cognitive ability/processing and a corresponding weakness in academic performance (as identified in Level I-A analysis). The first criterion is necessary to establish the presence of a disorder in a psychological process. Low achievement performance, in the absence of any cognitive deficiencies, does not meet criteria presented here and in other current conceptualizations of LD (see Table 2). 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 (beginning at about 1 SD below the mean of 100). The second criterion is necessary to establish a valid basis for linking the cognitive deficit to the academic deficit.

Level II-B: Re-evaluation 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 LD described herein, these deficits must not be primarily the result of exclusionary factors. Hypotheses regarding reasonable explanations (particularly situation-specific factors such as motivation, fatigue, etc.) for the observed cognitive deficit(s) must be rejected to conclude confidently that the data represent an accurate and valid reflection of true ability. When all appropriate exclusionary factors have been carefully evaluated and excluded as the primary reason for the observed cognitive deficits, the process may advance to Level III.

Level III: Evaluation of Underachievement

Advancement to Level III automatically implies that three necessary conditions for determination of LD have been met: (a) One or more academic ability deficits have been identified,

(b) one or more cognitive ability/processing deficits have been identified, and (c) 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 LD or whether the pattern of results may be better explained via alternative causes such as mild mental retardation or other factors known to have an adverse impact on both academic and cognitive performance (e.g., sensorimotor handicaps, lack of English language proficiency, etc.). Thus, Level III involves evaluation of all data to verify (a) that the student possesses specific and related academic and cognitive deficits and (b) that these deficits are circumscribed; that is, they exist within an otherwise *normal ability/processing* profile. Note that global/general ability scores (e.g., FSIQ) are neither calculated nor necessary for this analysis. When broad CHC ability/processing clusters are generated at Level II-A, it is most appropriate to conduct an *ability/processing—achievement* (or *aptitude-achievement*) *consistency analysis* at Level III to determine a pattern of underachievement suggestive of LD.

Given the historical predominance of the discrepancy model, evaluation of consistency may appear rather strange at first. As noted previously, 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—the two scores are more likely to be *consistent* with each other rather than discrepant.

Because consistency in scores that are within normal limits or even above normal limits already would have failed to demonstrate normative-based deficits, LD determination at this level is more concerned with scores that fall below the average range; however, a low aptitude score coupled with a low academic achievement score is insufficient to pass the current test for LD 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. Low ability/aptitude scores across the board or multiple low ability/aptitude scores with corresponding low achievement scores may be more suggestive of mild mental retardation—a condition that would preclude determination of LD 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 ability (or aptitude) and academic deficits represents underachievement.

Figure 2 provides an example of Level III Integrated Ability Analysis using data from the conormed Kaufman batteries of cognitive abilities/processes (i.e., Kaufman Assessment Battery for Children, second edition [KABC-II], Kaufman & Kaufman, 2004) and tests of achievement (i.e., Kaufman Test of Educational Achievement, second edition [KTEA-II], Kaufman & Kaufman, 2004). The conormed Kaufman batteries, like other conormed batteries (e.g., Woodcock-Johnson III Tests of Cognitive Abilities and Tests of Achievement, Woodcock, McGrew, & Mather, 2001a,b) are ideal for use in evaluation of suspected LD because they measure most of the abilities and processes listed at Levels I-A and II-A of the operational definition (see Figure 1). A review of the data in Figure 2 demonstrates that this individual has deficits in basic reading skills that are consistent with deficits in auditory processing (*Ga*) and speed of processing (*Gs*) as it relates to

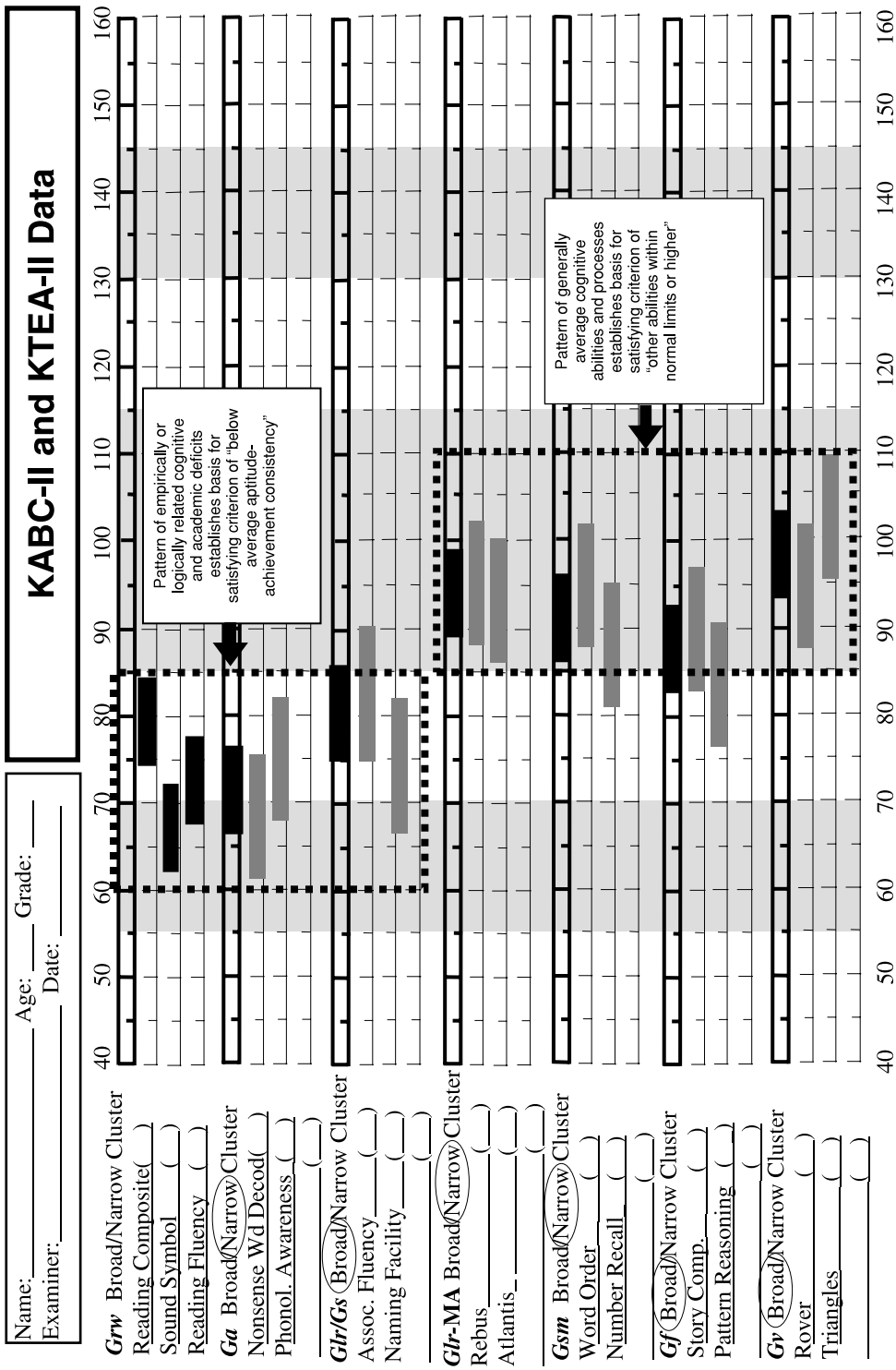


FIGURE 2. Example of an integrated ability analysis using KABC-II and KTEA-II data.

long-term retrieval (*Glr*). There is a large body of research that demonstrates the importance of *Ga*, *Gs*, and *Glr* in the acquisition of basic reading skills (see Table 1). Therefore, the aggregate of *Ga*, *Gs*, and *Glr* tests for this individual may be thought of as an *aptitude* for reading. The top left rectangle in Figure 2 highlights this individual's *below-average aptitude-achievement consistency*.

Level III analysis also requires that the evaluator document intact functioning. A below-average aptitude-achievement consistency is indicative of LD only when it occurs within an otherwise *normal ability profile*. The bottom-right rectangle in Figure 2 highlights the cognitive abilities/processes that are within the average range for this individual. The combination of below-average abilities in related cognitive and academic areas and intact functioning (i.e., average range or higher) in other cognitive (and academic) areas is consistent with LD.

Level IV: Evaluation of Interference With Functioning

When LD determination reaches this point, criteria at the previous three levels have presumably been met, thus supporting the presence of an LD. Further evaluation seems unnecessary, but an operational definition of LD based only on the previous criteria would be incomplete. One of the basic eligibility requirements contained in both the legal and clinical prescriptions for establishing LD refers to whether the suspected learning disorder actually results in significant or substantial academic failure or other restrictions/limitations in daily life functioning. Accordingly, in the matter of determining LD, the final analysis boils down to evaluation of the extent to which functioning, whether in the classroom or in other major life activities that require the skill, has been significantly and negatively affected. Essentially, Level IV analysis serves as a kind of "quality control" test that is designed to prevent the application of LD diagnosis in cases where real-world functioning is not judged to be substantially impaired as compared to others in the general population, irrespective of the patterns seen in the data.

The notion of interference with learning is not unique to the specification of LD contained in IDEA 2004. The *Diagnostic and Statistical Manual of Mental Disorders*, *Fourth Edition-Text Revision* (DSM-IV-TR; American Psychiatric Association, 2000) provides a similar criterion with respect to the diagnosis of academically related disorders. According to the DSM-IV-TR, "The learning problems significantly interfere with academic achievement or activities of daily living that require reading, mathematical, or writing skills" (p. 46).

Consistent with the DSM-IV-TR, the deficit or impairment in ability/processing identified across Levels I, II, and III must significantly interfere with academic performance (in one or more of the eight areas of achievement) or any other area involved in daily life functioning or activity that requires the use or application of the academic skills presumed to be deficient. Unfortunately, there is no accepted operational standard by which the conditions of "significant interference" or "adverse effects" can be readily evaluated. Perhaps the most reasonable standard comes from that which was already used to establish the preceding normative deficits—general learning performance that falls below the average range and that is significantly below that of the average person in the general population.

Ultimately, this final criterion reflects the need to take a very broad survey of not only the entire array of data collected on an individual during the course of assessment but also the real-world manifestations and practical implications of any presumed disability. In general, if the principles specified in Levels I through III have been followed and the criteria adhered to, it is very likely that Level IV analysis serves only to support conclusions that already have been drawn to this point; however, in cases where data may be equivocal, Level IV analysis becomes an important safety valve, ensuring that any representations of LD suggested by the data are indeed manifest in observable impairments in one or more areas of functioning in real-life settings. Level IV analysis helps to guard against the tendency to identify LD on the basis of insufficient data or

inappropriate criteria (e.g., presence of a discrepancy in the absence of normative deficits or statistically significant, but largely irrelevant, relative deficits).

Conclusions

This article began with a discussion of what may be the most significant problem in research and practice as it pertains to LD identification—lack of a common language or standard nomenclature. It was noted that traditional definitions, methods, and diagnostic criteria for determining LD have not resulted in advances of knowledge so much as they have served to highlight the disparities in conceptualizations of LD. The emergence of RTI as yet another paradigm for conceptualizing LD has only exacerbated the problem, not so much because it is an inherently different perspective but because there was little consistency in understanding LD prior to it.

The lack of consistency in understanding LD is due, we believe, to: (a) failure to incorporate a well-validated guiding theory; (b) vague and nonspecific operational definitions of LD; and (c) lack of a systematic, comprehensive framework for LD assessment to guide practice. In addition, we recognize that RTI and norm-referenced ability testing are not mutually exclusive, such that either one or the other is used to diagnose LD, but not both. Rather, we believe that both are necessary to establish the presence of LD. This integration of both approaches occurs by placing RTI at the forefront of a comprehensive framework for LD determination, taking advantage of its emphasis on the systematic evaluation of response to instruction. By the time the third or fourth tier in an RTI approach is reached, norm-referenced ability testing will prove its value. Norm-referenced ability testing offers the means to examine the specific nature of an individual's cognitive abilities/processes within the context of a well-validated theory that specifies the relations between academic abilities and specific cognitive constructs.

RTI and norm-referenced ability testing are complementary, not competing, approaches. The operational definition presented here integrates RTI methods with modern theory on the structure of cognitive and academic abilities/processes in a manner that may lead to better consistency in accepted conceptualizations of LD. Ultimately, integration of RTI and norm-referenced ability testing as outlined in this article may address the communication problems that have hampered efforts by researchers and practitioners in their goal of understanding LD. Only when there exists a common language among researchers and practitioners will progress toward this goal materialize.

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