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Solving the Problem of Learning Disabilities

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Dyslexia and other learning disabilities are not being properly recognized and treated in our educational system or society at large. Unrecognized and untreated learning disabilities represent a serious social and economic problem, not only to the individual but to society as a whole. For example, antisocial behavior, as seen in prison populations and juvenile detention centers (e.g., Grigorenko, 2006; Quinn, Rutherford, Leone, Osher, & Poirier, 2006; Zhang, Barrett, Katsiyannis, & Yoon, 2011), homelessness (Barwick & Siegel, 1996), substance abuse (McClelland, Elkington, Teplin, & Abram, 2004), suicide (McBride & Siegel, 1997), and emotional difficulties (Livingston, Siegel, & Ribary, 2018) are often a result of dyslexia and other learning disabilities that have not been properly identified and/or treated.

The system has failed on all levels. It is chaotic and unsystematic, the result of flawed logic and ignorance of, or unwillingness to consider, the available research. In this article, I document these issues and propose solutions. The solutions are relatively inexpensive and practical, certainly much cheaper and more humane than the costs of the serious secondary problems created by the widespread lack of attention to learning disabilities.

Improving Identification Procedures

In the current system, learning disabilities are not being properly identified and treated. Identification procedures, in most jurisdictions, are costly and unnecessary. The first step in solving the issues of dyslexia and other learning disabilities is to develop accurate and systematic, but not costly, identification procedures. Currently the procedures for identifying students with learning disabilities are complicated and require extensive testing. A detailed psychoeducational evaluation is usually mandated, typically necessitating an intelligence (IQ) test. However, in most cases, an IQ test is unnecessary, as illustrated in the following.

Often, identification procedures for dyslexia and learning disabilities require that difficulties in achievement, particularly reading and/or mathematics, are unexpected in relation to "general cognitive abilities." This "unexpectedness" is typically interpreted with regard to intelligence, as defined by a score on an IQ test – an archaic and inappropriate strategy referred to as the discrepancy definition of learning disabilities. In order to be considered to have a learning disability, in other words, an individual must demonstrate a significant difference, or discrepancy, between his or her IQ score and reading or mathematics achievement score.

The use of discrepancy in the definition of learning disabilities is incorrect and not supported by empirical research. The inclusion of a measure of intelligence is unnecessary, and has excluded students from being identified as having a learning difference who have, in fact, experienced learning differences (for a review of the evidence, see Fletcher, Francis, Rourke, Shaywitz, & Shaywitz, 1992; Siegel, 1988, 1989a, 1989b, 1992). The use of the discrepancy definition in any form has been and is detrimental to a great many individuals. As the theoretical and empirical shortcomings are being identified, the use

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of the discrepancy model to identify learning differences is indefensible, therefore.

Although a discrepancy is expected in terms of reading or mathematics "… in relation to other cognitive abilities" (Lyon, Shaywitz, & Shaywitz, 2003, p. 2), this is a characteristic demonstrated by many individuals who have learning difficulties, but it is by no means an important or relevant aspect of learning disabilities identification and, therefore, should not be part of the identification criteria.

Specifically, the current model requires a predetermined discrepancy or gap between achievement and ability, such that a deficit exists that necessitates special education or related services for a student to benefit from education. In some schools, the gap has to be quite large, as much as 1.5 standard deviations. That is, the difference between the student's IQ score and his or her achievement score would need to be 22 standard score points or more. For example, if the IQ was 100, the standard score in reading would have to be 78 or lower. Typically, individuals with standard scores below 86 or even 91 on tests of reading and/or mathematics are experiencing difficulties, and if the discrepancy definition is used, these individuals would not have access to services unless they had IQ test scores in the above-average range.

Historically, the discrepancy definition has led not only to under-identification but also exclusion from interventions that could have assisted students in becoming competent readers, for example (Siegel, 1989a, 1989b). Research has substantiated these potential difficulties. For example, in various studies, when good, dyslexic readers (poor readers who met the discrepancy definition) and intelligence-commensurate poor readers (poor readers who did not meet the discrepancy definition) were compared, both groups of poor readers performed significantly poorer than the good readers, but not statistically different from each other (e.g., Hurford, Johnston et al., 1994; Hurford, Schauf et al., 1994; Siegel, 1992; Stanovich, 1991; Vellutino, Scanlon, & Lyon, 2000). In another study, 250 students with reading disabilities and 719 nondisabled students were placed into IQ-level groups based on their performance on the *Wechsler Intelligence Scale for Children-Revised*. Results showed that measures of reading, spelling, and the understanding of syntax were better predicted by the presence or absence of a reading disability than by IQ test scores (Siegel, 1988). These studies highlight the reality that poor readers, that is, individuals who had significantly poor reading skills, read similarly regardless of their scores on IQ tests. Thus, the most important finding was that their reading performance could not be differentiated based upon measures of intelligence. In addition, there are no differences between individuals with or without an ability achievement discrepancy on functional MRIs (Tanaka et al., 2011), suggesting a lack of neurological differences between the discrepant and non-discrepant groups.

Under the discrepancy formula, it is assumed that even though poor readers from different IQ group levels read comparably, the poor readers with higher levels of intelligence benefit more from intervention. But the data do not support this assumption. In fact, regardless of their intellectual abilities, poor readers benefit from interventions at statistically identical levels. The major factor is whether or not students receive interventions appropriate for the reading difficulties they are experiencing (e.g., Hurford, Johnston et al., 1994; Pogorzelski & Wheldall, 2002; Stage, Abbott, Jenkins, & Berninger, 2003; Weber, Marx, & Schneider, 2002).

Even if the discrepancy definition is not used, there are conceptual problems with the use of intelligence tests. Intelligence tests are generally very heavily loaded on vocabulary and other language measures, memory, and motor measures, which we now understand are weaknesses for many individuals with learning disabilities (Siegel, 1989a, 1989b). As a result their intellectual functioning is more likely to be underestimated.

To make matters worse, the development of reading and literacy skills fosters the cognitive skills assessed with intelligence and aptitudes tests. Not only do good readers become more competent readers as a function of applying and practicing their reading skills, these readers are further developing their cognitive skills en route to commensurate improvements in scores on cognitive and intelligence tests. The opposite would be true for poor readers. Consequently, according to the discrepancy model, many poor readers would not reach a large enough gap between measures of reading and their IQ score to warrant inclusion in interventions, despite being in desperate need of interventions for their poorly developed reading skills.

Siegel and Himel (1998) directly examined this issue and found an inverse relationship between the age of children with dyslexia and their IQ scores. That is, the older children had lower IQ scores than the younger ones. This finding not only indicates that intelligence tests tap into the weak verbal abilities of the child with dyslexia, which then leads to an underestimate of his or her intelligence, but also highlights the absurdity of the discrepancy defini-

tion. That is, the discrepancy is reduced, thus making the student no longer eligible for intervention services. According to Stanovich (1986), "The cognitive consequences of the acquisition of literacy may be profound" (p. 374). Poor readers have less experience reading and gain less from the process of reading due to their inferior reading skills, which then affects the development of knowledge, memory, and other cognitive abilities.

Given these limitations, the discrepancy formula is untenable and unethical. It is inappropriate and unjust to deny a child educational services based on an empirically discredited form of classifying children into those who receive intervention services and those who do not.

The Patterns of Strengths and Weaknesses Model

Currently, an assessment for dyslexia or other learning disabilities often includes a number of tests of cognitive processes. The idea behind this type of assessment is that individuals with learning disabilities show a pattern of high ability in some areas of cognitive functioning and significant weaknesses in others, called the Pattern of Strengths and Weaknesses model (PSW). According to this approach, this unevenness is the defining characteristic of a learning disability and is a requirement for a person to be said to have a learning disability. If a student has a flat profile, without much deviation in terms of strengths and weaknesses, the proponents of this model would not identify this individual as having a learning disability.

The Wechsler Intelligence Scale for Children (WISC-V; Wechsler, 2014), for example, measures verbal comprehension, fluid reasoning (a cognitive ability that requires minimal prior knowledge to solve novel tasks), visual processing, processing speed, and working memory. The *Woodcock-Johnson Tests of Cognitive Abilities* (WJ IV; Schrank, McGrew, & Mather, 2014) measures comprehension-knowledge, long-term retrieval, visual-spatial thinking, auditory processing, fluid reasoning, processing speed, and short-term memory. These tests, along with similar instruments, were designed to examine several aspects of cognitive functioning and are used to provide a pattern of an individual's strengths and weaknesses.

Although the PSW model appears to provide an excellent basis for identification of learning disabilities, including dyslexia, it is essentially the discrepancy model lightly disguised. Thus, it requires that there be irregular patterns among the various cognitive abilities and achievement scores and that the individual's intellectual functioning fall in the average range. The requirement that intelligence be in the average range is analogous to the discrepancy model and, once again, will exclude students who have reading difficulties who do not meet this requirement. In short, the evidence for the PSW approach, as outlined below, suggests that, like the discrepancy model, it is not very useful in identifying learning differences.

There are several forms of the PSW model: the Concordant/Discordant model, the Cattell-Horn-Carroll Operational model, the Discrepancy/Consistency model, and the Hypothesis Testing (HT-CHC) Cattell-Horn-Carroll Operational model.

The Concordant/Discordant model (Hale & Fiorello, 2004) identifies individuals with specific learning disabilities by providing evidence that a weakness in achievement is related to a weakness in cognitive ability. Evidence must also be presented that demonstrates that the cognitive abilities that are not related to the achievement difficulties are not weak. For example, in this formulation, a student who has weaknesses in phonological/auditory processing that lead to weaknesses in the achievement areas of reading and spelling cannot have any other weaknesses in processing or achievement. Of course, this situation is unlikely; most people with learning difficulties have weaknesses in a variety of areas.

The Cattell-Horn-Carroll Operational model (Flanagan, Ortiz, & Alfonso, 2007) uses the Cattell-Horn-Carroll model of cognitive abilities to examine strengths and weaknesses through an examination of the broad cognitive abilities (i.e., Comprehension-Knowledge, Fluid Reasoning, Quantitative Knowledge, Reading and Writing Ability, Short-Term Memory, Long-Term Storage and Retrieval, Visual Processing, Auditory Processing and Processing Speed) and compares the relationships between these areas and corresponding areas of achievement. This model, then, identifies students with specific learning disabilities based on evidence showing that a weakness in achievement is linked to a weakness in one of the broad cognitive abilities outlined above, and that the broad cognitive abilities not related to the achievement weakness are not weak.

The Discrepancy/Consistency model (Naglieri, 1999) identifies specific learning disabilities by examining the variability of an individual's cognitive scores. If a particular score is significantly low

compared to the individual's other cognitive scores and meets the threshold of significantly low based on predetermined values (e.g., less than a standard score of 85), then that area is determined to be a weakness. Strengths are identified in the same, but opposite manner (i.e., scores greater than a predetermined value).

The Hypothesis Testing Cattell-Horn-Carroll model (Flanagan, Fiorello, & Ortiz, 2010) combines aspects of the Cattell-Horn-Carroll and concordant/discordant models. Flanagan et al. (2013) define a cognitive or academic weakness as a score lower than a standard score of 85 and a cognitive or academic strength as a standard score greater than 90.

All the variations of the PSW model require a weakness in a cognitive area for identification of specific learning disability to occur. Unfortunately, "… experimental studies showed that cognitive profiles had limited diagnostic accuracy in identifying individuals with learning difficulties" (Beaujean, Benson, McGill, & Dombrowski, 2018, p. 2). (Beaujean and colleagues are not the only researchers critical of the PSW model [e.g., McGill & Busse, 2016; Miciak, Taylor, Denton, & Fletcher, 2015].)

In addition, one of the premises of all of these models is that the individual who is being considered for a specific learning disability must possess "… at least an average level of general cognitive ability or intelligence" (Flanagan et al., 2010, p. 745). As noted above, there is no evidence that this is the case. For individuals with dyslexia/reading difficulties, demarcating groups by intelligence provides an artificial differentiation between those groups – groups that perform nearly identically on measures of reading and its subskills and groups that benefit equally from interventions.

One of the assumptions of the PSW model is that the performance of students with learning disabilities differ from that of their typically achieving peers. But there is great individual variation in using PSW analysis, and this difference between the performance of students with and without learning disabilities is not always found. Therefore, the diagnostic utility and validity of these models is questionable. For example, D'Angiulli and Siegel (2003) found that typically achieving children and children with learning disabilities did not differ in patterns of performance on IQ tests. That is, similar numbers of the two groups who demonstrated discrepancies between their verbal and performance IQ scores and had significantly low scores on Digit Span, a working memory test, and Coding, a memory and motor test. Finally, in a simulation study examining various models of patterns of strengths and weaknesses, Stuebing, Fletcher, Branum-Martin, and Francis (2012) noted that none of them was very useful in identifying students with learning disabilities. Most important, a particular cognitive profile of strengths and weaknesses does not predict who will benefit from remediation or what particular intervention strategy should be employed. This is particularly the case for individuals with reading difficulties.

Opportunity Costs of Current Assessment Models

Requiring these lengthy and detailed assessments may mean that many people who are struggling with reading, writing, and/or mathematics do not get the assessment that is required. For example, there is often an 18- to 24-month wait for assessment within school systems. If an assessment is not conducted by the school system, and often it is not because it is impossible for staff psychologists to test all the students who need to be tested, it is costly (1,500-3,000 US dollars) to seek private testing – a cost that is too much for many families to afford. Further, in most postsecondary institutions, there is no provision for any free or low-cost assessment. Nevertheless, a psychoeducational evaluation is usually necessary for a designation and subsequent intervention and accommodations, meaning that children whose parents cannot afford it, or postsecondary students who cannot afford it, are denied intervention and/or accommodations. This situation is clearly an indication of a lack of social justice.

Appropriate Assessment

All that is necessary to confirm whether or not somebody has a learning disability is to assess their reading, spelling, and mathematics and, perhaps, writing. Standardized tests are available in English and some other languages for this purpose, and teachers and other school personnel can easily be trained to administer them.

What then is necessary? To meet this definition and to understand a student's academic strengths and challenges, we need a variety of achievement tests whose subtests directly measure the potential deficiencies. Tests of reading are obviously essential. It is critical to measure two basic reading skills, word recognition and decoding.

Reading

Word recognition. On word recognition tests (e.g., *Wide Range Achievement Test*, Letter and Word Identification on the *Woodcock-Johnson Test of Achievement,* the *Wechsler Individual Achievement Test*), the person reads words out loud that vary in difficulty, and his or her performance is scored and compared to that of other people of the same age.

Decoding. Decoding skills involve the ability to associate sounds with letters such that letters are translated or decoded into their respective sounds. This ability is assessed by asking a person to read words and pseudowords (nonwords that are legal and pronounceable combinations of letters but not real words in the language in question). The use of pseudowords in these tasks is very useful because some struggling readers use strategies to memorize the visual representations of words. In these cases, it may appear that the individual has appropriately developed decoding skills, even if it is not the case. The use of pseudowords prevents the use of this strategy and, therefore, provides a more accurate representation of the individual's ability to decode as he or she has not encountered these pseudowords previously (e.g., *pum, nafotbil*). In other words, pseudowords force the individual to engage in decoding.

Decoding is essential for reading acquisition and word recognition, which eventually becomes automatic in skilled readers. The efficiency with which the processes occur is also important. If a student takes considerable time to decode and read a word, the time and effort involved in those tasks will consume cognitive effort, which will then interfere with understanding the text. One test that measures the speed of reading words and pseudowords is the *Test of Word Reading Efficiency* (TOWRE), which measures how many words and pseudowords the person can read in 45 seconds.

Accuracy and speed. Tests of accuracy and speed of word recognition and pseudoword reading are absolutely essential for understanding whether a student is experiencing reading difficulties. In fact, it is possible to make a case for dyslexia just based on poor performance on any one of these tasks.

When evaluating the reading skills of struggling readers, it is important to analyze the items on which they make errors and the types of errors that are made. Error and item analyses provide clues as to the types of interventions that would be of most benefit to a given student. For example, if someone is dictated the word take and spells it tak, this is a sign of a problem with understanding that the "final e" indicates that the vowel will likely be long rather than short. Examples of approaches that have used analyses of items and errors and related the results to intervention include Kern and Hosp (2018), Odegard, Cooper, Hirschmann, and Alexander (2017), and Steacy, Elleman, Lovett, and Compton (2016).

Spelling. Other tests are useful for understanding academic performance. For example, learning about a student's spelling of words is important. Spelling is evaluated by dictating a list of words to the person, who then writes them (e.g., Spelling subtest of the *Wechsler Individual Achievement Test* or the Spelling subtest of the *Wide Range Achievement Test*; WRAT).

Additionally, measuring reading comprehension is important in understanding what meaning the person is able to get from the text. However, consideration should be given to the test passages selected, because reading comprehension depends at least in part on the reader's background knowledge that is assumed as part of the reading of the passage. Thus, although decoding, vocabulary, and knowledge very accurately predict reading comprehension, a lack of content knowledge likely will hamper reading comprehension, whereas expert knowledge likely will enhance reading comprehension (e.g., Alfassi, 2004). In addition, good reading skills are related to vocabulary growth (Duff, Tomblin, & Catts, 2015).

Time limits. Most reading comprehension tests require that the test be completed within a time limit. Lesaux, Pearson, and Siegel (2006) examined the reading comprehension ability of dyslexics to perform in two conditions: the typical condition in which students have a limited amount of time to complete the task vs. an unlimited amount of time to complete the task. Although the conditions had little effect on good readers, the dyslexics performed significantly better in the untimed condition.

Even for tests of reading comprehension, we should not just consider the overall score, but ask whether or not the questions were answered correctly within the time limit. For example, if a person answers few questions but all the answers are correct, then he or she understands what has been read, but just reads slowly. In addition, reading comprehension tests can place different demands on the respondent. Some item can be answered using verbatim information provided in the text, while others can only be answered by going beyond the explicitly stated information and making an inference.

Dictation. A spelling dictation test for both words and pseudowords should be included. Analyses of error patterns, as conducted by Lennox and Siegel (1996), would be useful for planning interventions. For example, errors such as *nature* spelled as *nachure* indicate reasonable phonetic skills but problems with orthographic processing. *Circle* spelled as *sicel* may indicate a problem with hearing and/or remembering the sounds in words and suggests phonemic awareness training. Of course, one would not recommend an intervention based on one error; these are just included as examples.

Mathematics

Speed and accuracy. The assessment of mathematical skills should include the speed and accuracy of mathematical calculation and problem solving. An analysis of errors is critical. It is important to note whether or not the individual makes errors that indicate that he or she does not understand place value; for example, adding 29 and 13 and producing 312 as the answer.

Mathematical reasoning. It is important to note that existing tests of mathematical reasoning are not independent of computational skill. There was, however, one good test of mathematical reasoning that did not involve computational skills, the Missing Elements test of the *Key Math Test*. Using this test, the student was presented with a problem such as "There are 36 chairs in a room. How many rows are there?" and was asked to say what additional information would be needed to solve the problem. Unfortunately, this subtest disappeared from later versions of the *Key Math Test*.

Writing

Assessment of writing skills is important but extremely difficult. The writing process is not something that can easily be captured in a brief assessment. In addition, there is the issue of handwriting; many people write directly on the computer. Of course, one could always ask for samples of written work, but there is no information about the conditions under which it was done and, therefore, no standardization. The *Woodcock Johnson* has Writing Fluency and Writing Samples subtests; these can be useful, but there is some subjectivity in the scoring. Another instrument is the *Test of Written Language* (TOWL), but it is also difficult to score objectively. It may be useful to have students tell a story orally based on the pictures on the TOWL. Often, one can see creativity in the oral story that one does not find in a poorly handwritten story. Again, objective scoring of the story is not practical, but the test can yield useful information about a student.

Early Identification

Early identification of children at risk for learning disabilities is critical. Although we know how to detect children at risk for reading difficulties early in their school career, even before they start reading instruction, systems are not in place in most jurisdictions to find these children.

In studies of early identification of and intervention for children at risk for reading difficulties, we found that children at risk for reading difficulties can be detected in kindergarten, even before reading instruction begins. The screening is efficient and easy to administer. Children are administered a letter recognition test and some phonological awareness tasks, such as phoneme deletion, which requires them to say, for example, *pink* without the "p" sound (the sound is said, not the letter). For a more complete description of this technique, see Siegel (2018).

Early identification for potential reading difficulties is cheap, easy to administer, and effective. With brief training, teachers can do it. The advantages of having teachers do the identification is that they become more aware of the child's strengths and difficulties. Unfortunately, research on identifying children at risk for mathematical difficulties and providing an intervention is still in its infancy stage.

Early Intervention

Early identification is meaningless unless an intervention program is in place to help students who are identified as being at risk. We know that if we intervene with children with reading difficulties early, intervention is more effective and cheaper (Fawcett, Lee, & Nicholson, 2014; Griffiths & Stuart, 2013).

With regard to early reading intervention, we have conducted studies of Firm Foundations (summarized in Siegel, 2018), a locally developed (British Columbia, Canada) program to help children understand the sounds of the English language and how letters have these sounds. The program is effective, and helps both children whose first language is English and children who are learning English as a second language. Brief teacher training and the purchase of the Firm Foundations are the only costs involved, and these are minimal.

Improving the Curriculum

In many faculties of higher education, teachers are not properly taught about teaching reading, writing, and mathematics. For example, in a review of studies about the knowledge and understanding of teachers about teaching reading and dyslexia, Washburn, Mulcahy, Joshi, and Banks-Cantrell (2016) found that teachers often lacked knowledge about important concepts related to reading, such as phonemic awareness and morphology. Teacher knowledge of reading-related concepts impacts student performance, and inadequate knowledge on the part of teachers is correlated with poor performance of students. Therefore, improvement of teacher education should be an important priority.

Recognizing Parents and Teachers

One aspect of solving the issues related to learning disabilities involves providing appropriate educational support. Within the educational system, there is a tendency for some school personnel to belittle or even ignore the role of parents in helping their children succeed (Siegel, 2013, 2016), thereby creating a difficult educational environment for the child. It is also sometimes the case that teachers' careful observations about a child's difficulties are discounted by the school system.

Coping Strategies

To help people with learning disabilities, we need to recognize their talents and abilities. Traditionally, we have not paid enough attention to the strengths of people with learning disabilities. Many have excellent abilities in nonacademic areas such as music, art, dance, drama, sports, or carpentry, to name a few. Some have developed coping strategies, but these strategies should be taught on a larger scale. For example, some use humor and good reasoning skills to help them deal with bullies. Madaus (2005) has outlined strategies for dealing with the transition to postsecondary education.

Solutions

In summary, the following are solutions to the problems of learning disabilities.

1. Streamline assessments of learning disabilities and make them available without charge to anyone.
2. Practice early identification and intervention on a large scale in every district, as essential for success.
3. Improve the teaching of reading and mathematics, using evidence-based methods.
4. Respect parents and teachers and their observations.

How can governments and school systems find the money to fund these initiatives? There are several ways. The system of psychoeducational testing currently used is unnecessarily complex and costly. A more streamlined system would save thousands of dollars. For example, abolishing "high-stakes testing," because group multiple-choice tests tell us little about the basic skills of an individual. If governments and school systems put serious efforts into help peopling with learning disabilities using the methods outlined above, we would significantly reduce the incidence of academic, social, and emotional problems, which come at a great cost to both the individual and society.

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Note

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