CHAPTER 1

Introduction

Since the federal designation of learning disabilities (LDs) as a "handicapping condition" in 1968 in the United States, the proportion of children identified with LDs increased steadily until the past decade. At its peak, students with LDs represented almost one-half of all children receiving special education services (U.S. Department of Education, 1999). But from 2002 to 2011, the number of children in special education with LDs declined about 2% per year, or a total of 18%, although the number of students identified for special education declined only 3% (National Center for Learning Disabilities, 2014). These figures have stabilized through 2016 to about 35% of children served in special education. Although autism and "other health impaired" (OHI) are now the fastest growing eligibility categories, partly because of the explicit inclusion of children with attention-deficit/hyperactivity disorder (ADHD) in the OHI category, students with LDs are still the largest group, representing about 4.6% of all students in the U.S. public education system (National Center for Education Statistics, 2017).

While there was relatively little research on LDs at the time that the U.S. federal special education legislation was initially enacted in 1975, significant progress has been made in understanding and treating LDs involving reading, mathematics, and written expression since then. As we noted in the first edition of this book (Fletcher, Lyon, Fuchs, & Barnes, 2007), major advances had been made in classification and definition issues, cognitive processes, neurobiological correlates involving the brain and genetics, assessment practices, and intervention. Lyon and Weiser (2013) provided additional coverage of advances from 2007 to 2011, including an analysis of the scientific quality of these advances. Much of this progress was in areas related to word reading, or dyslexia (see Chapter 6), especially in younger children because of a research emphasis on early identification and prevention.

Since 2007, the word-reading area has expanded across the lifespan and considerable progress has been made in domains related to reading comprehension, math, and written expression (Lyon & Weiser, 2013). The advances in intervention are especially promising. Although research has shown that reading and math

disabilities are preventable in many children, it is now apparent that there are both preventative and remedial interventions in all the five domains of LDs reviewed later in this book (word reading, reading comprehension, math computations, math problem solving, and written expression). Service delivery models based on response to intervention (RTI), now more generally termed "multitiered systems of support" (MTSS), have emerged as schoolwide approaches to instruction and intervention. These approaches are also sources of controversy, especially when the identification of students with LDs is considered (Reynolds & Shaywitz, 2009).

Knowledge about neurobiological factors underlying reading, math, and writing disabilities has been consolidated and more is known about the intrinsic link of genetic factors that put the brain at risk for LDs. Environmental factors that provide the context through which LDs are expressed, such as instruction and the home literacy and language environment, can increase or reduce risk for these LDs. Knowledge of neurobiological correlates is not to the point where it can or should affect instruction, but is important for informing theory and understanding of LDs. The impact on instruction, especially the need for *explicit* approaches for children who are struggling, is very apparent when neuroscience research is evaluated. The neural systems that mediate reading and math skills develop through instruction and experience, which must be explicit for many children if these systems are going to emerge.

In the first edition of this book, we observed that a comprehensive model had emerged for word-level reading difficulties (dyslexia), the most common LD, which is grounded in reading development theory and accounts for neurobiological and environmental factors in addition to the effects of intervention (Pennington, 2009; Elliott & Grigorenko, 2014). We reiterate that the same theory of reading development that explains how children acquire reading skills explains why some fail, unifying the research on LDs in reading and the normative development of reading ability, and making accounts of LDs more compelling. This appears true for other LDs. The defining attributes of LDs (e.g., low achievement, inadequate instructional response) appear normally distributed in the population and there is little evidence of qualitative variation that would suggest categories, much less where LDs begin in relation to typical development. Such decisions are often resource-driven.

Despite this scientific progress, the construct of LDs and the many definitions that serve as conceptual frameworks for their identification and treatment continue to be misunderstood. The field continues to be plagued by pervasive disagreements about the definition of LDs, diagnostic criteria, assessment practices, treatment procedures, and educational policies. The translation of scientific progress into classrooms remains difficult (Chapter 11), and anecdotes and older belief systems continue to prevail. If anything, there is less emphasis on the use of science as a basis in 2018 than there was in 2007, a heady time for scientists investigating LDs.

Why a Second Edition?

In writing a second edition, we aimed to continue to integrate the disparate sources of information into a more coherent account of LDs, beginning with an evidence-based approach to definition and classification (Chapter 3) and the implications of

what we describe as a hybrid approach for assessment and identification (Chapter 4). With an adequate classification, it becomes possible to comprehensively discuss research on the nature, types, causes, and treatment of LDs (Chapters 5–10), thus beginning to integrate science and practice (Chapter 11).

This second edition also addresses the horizontal integration of knowledge on LDs, providing less depth within different domains of knowledge in favor of the connections across these domains and the boundaries across disciplines. Because science has advanced, there is a need to revise and update this account. In addition, because of the difficulties with implementation of this scientific knowledge, we hope to provide a clearer set of principles about how to implement scientific knowledge in relation to instruction (Chapter 5), with an emphasis on examining the converging evidence in support of different instructional practices in Chapters 6–10. Instead of detailed, systematic reviews of the literature, we tried to focus even more on general principles that have emerged and to provide more concrete, practical guidelines to facilitate intervention. Hence, we have altered the book by dropping the chapter on history with the exception of recent updates in Chapter 2, which is a new chapter addressing issues related to the validity of the LD construct. The history chapter from the first edition is available online (see the box at the end of the table of contents). Thinking about the simple question of whether LDs represent "real" entities is important as policymakers among others struggle with resource issues and ideologies that interfere with implementation of the intensive interventions needed by many individuals with LDs. Chapter 3 is an updated chapter that focuses on identification issues, illustrating how problems identifying individual people with LDs underlie any attempt to categorize inherently normal distributions (i.e., achievement, instructional response, cognitive functions) regardless of the assessment method employed. In addition, Chapter 3 updates the research on identification methods, specifically questioning the reliability and validity of approaches that focus on assessment of students in isolation of instructional response.

Chapter 4 updates assessment approaches, especially in the context of MTSS methods of service delivery. For clarification, we will refer to RTI when we discuss identification methods and to MTSS as a broader service delivery model consistent with the reauthorization of the U.S. Elementary and Secondary Education Act in 2015, also called the Every Student Succeeds Act (*www.ed.gov/esea*). Chapter 5 is new, focusing on principles of instructional design for people with LDs. Chapters 6–9 focus on LDs involving word reading and spelling (dyslexia), specific reading comprehension, math computations (dyscalculia) and problem solving, and written expression. All four chapters have been extensively updated, reflecting the amount of research on LDs in the past decade. Whenever possible, we refer to meta-analyses (quantitative syntheses) of research and use individual studies to illustrate interesting findings and effective interventions.

We no longer discuss reading fluency as a separate LD, but instead focus on the more general issue of automaticity in reading, math, and writing in the new Chapter 10. The final chapter (Chapter 11) discusses issues related to the difficulties with implementation and scaling of scientific knowledge from contemporary and historical perspectives, with an eye toward lessons learned over the past decade.

An Overarching Framework

Figure 1.1, which was introduced in the first edition, presents a framework for understanding the different sources of variability that influence academic outcomes in children with LDs. The framework encompasses three levels of analysis that underlie an integrated account of LDs and is anchored in a hypothetical classification of LDs based on variations in academic skills. Evidence suggests five major prototypes of LDs involving word recognition (and spelling), reading comprehension, mathematics computations, mathematics problem solving, and written expression. These domains have been selected both because of their prominence in current definitions of LDs, and because most children and adults are identified as having LDs manifest unexpected underachievement or atypical development in one or more of these areas.

For each LD, the primary manifestation of the disorder represents specific academic skill deficits in the five domains of LDs. By referring to these domains as "disabilities," we use historically established language, but would add that what makes LDs a disability rather than a disorder or a deviation from normal development is (1) the severity of underachievement, which is unexpected because the individual has not responded adequately to instruction that is effective for most individuals; and (2) the evidence of adaptive impairment, such as poor school achievement. Thus, disability determination is always a two-pronged determination based on the existence of a problem and evidence of adaptive impairment, the latter representing the weakest part of most definitions of LDs (see Chapter 2).

The second level of analysis involves person-level characteristics, including core cognitive processes (e.g., phonological awareness and vocabulary) that are correlated with the academic skill deficits (e.g., word recognition skills and reading comprehension) in addition to academic strengths. Reading, math, and writing are also complex cognitive skills that represent the manifestations of other cognitive
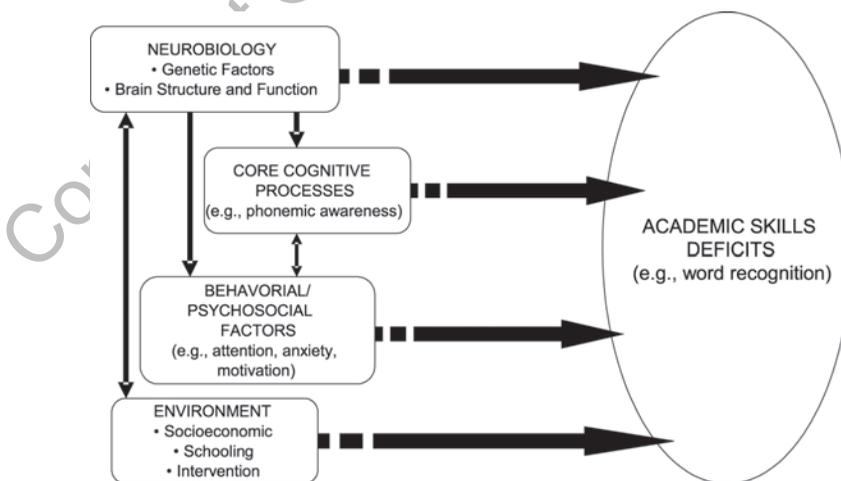

FIGURE 1.1. Framework representing different sources of variability that influence academic outcomes, the primary manifestations of the disability, in children with LDs.

skills, but separating academic and core cognitive skills is useful for assessment and intervention purposes. Academic strengths and weaknesses are also influenced by a second set of person-level characteristics encompassed in the psychosocial domain, such as motivation, social skills, and behavioral problems involving anxiety, depression, and/or inattention that interfere with performance in academic domains. The arrow between core cognitive processes and behavioral/psychosocial factors is bidirectional because cognitive difficulties can also lead to problems with, for example, attention and social skills, which can in turn influence academic abilities. Neither type of person-level characteristics (i.e., cognitive and behavioral/psychosocial factors) should be considered diagnostic of LDs, although the psychosocial/contextual component and the possibility of other co-occurring disorders must be evaluated in order to plan intervention. The need to evaluate cognitive characteristics in isolation of academic skills is controversial and we argue for direct assessments of academic skills and psychosocial components because of the absence of evidence that assessment of cognitive skills adds value to intervention (Chapter 3) and the lack of evidence that interventions based on cognitive skills generalize to academic skills (Fletcher & Miciak, 2017; Mann, 1979).

The third level of analysis involves neurobiological and environmental factors. Neurobiological factors include genetic and neural sources of variability that impact academic skill deficits either indirectly through their influence on person-level characteristics or directly on attainment of the academic skills. Environmental factors are contextual and include the social and economic circumstances in which a person develops and functions, as well as schooling influences, such as the quality of the school and different interventions. The arrow linking neurobiological and environmental factors is bidirectional, indicating the synergistic influence of these domains. Although the idea that neurobiological factors lead to LDs is not new, it is important to recognize that instruction and experience reorganize the neural systems involved in LDs and influence the expression of biological factors. In an integrated account of LDs, all three levels of analysis must be considered. As in the first edition, we focus on the relations of academic skills with core cognitive processes, neurobiological factors, and intervention.

Historically, research on LDs has emphasized the second (and third) levels of the framework as opposed to the first level of analysis. Although Figure 1.1 includes multiple levels of analysis, a strong classification is based on a parsimonious set of markers that identify members into the different parts of the classification. Our discussion of academic skill deficits attempts to identify these markers, which should predict the cognitive and neurobiological factors. There are important relations with the psychosocial and environmental variables that are essential for understanding the impact of intervention. Thus, adequate identification of valid markers and the effectiveness of interventions require a focus on achievement, instructional response, and other factors that impact the development of academic skills. These latter factors are typically used to exclude people from LD classifications. However, without a focus on these factors, many children will be identified as LD for whom the explanation of the disability is *poor instruction* and not *unexpected underachievement*.

The strengths and weaknesses in cognitive skills that some view as essential to the nature of LDs (e.g., phonological awareness, working memory) can be

accounted for simply by assessing the achievement domains (e.g., word recognition). Over the past decade, little evidence has emerged showing that cognitive skill assessments contribute significant value-added information to predictions of academic outcomes (Stuebing et al., 2015) or to treatment planning (Kearns & Fuchs, 2013), although working memory and oral language remain viable candidates (Peng & Fuchs, 2016; L. S. Fuchs et al., 2014b). This does not mean that cognitive skills are not related to LDs or that research might one day identify a role for assessment and intervention with cognitive skills, but it has yet to emerge (Schneider & Kaufman, 2017). Regardless, routine assessment of cognitive skills is not indicated, just as the impressive research base on neuroimaging does not suggest a need for brain scans of each child suspected of LDs. The neural correlates are predicted by the tasks used to elicit brain activation (word reading, math calculation, etc.), which should also predict the correlated cognitive processes, again demonstrating the major role of levels of achievement in the prediction and identification of LDs. The ability to make these predictions and simplify classification, identification, and assessment processes signal the emergence of an evidence-based approach for classifying LDs, with simple decision rules focused on direct assessment of key academic skills that leads to the rapid provision of effective interventions, which is the goal of identification.

From our perspective, the future of LDs is tied to the scientific process, and the field must embrace the evolving process of scientific research and move away from poorly verified clinical intuition and slick marketing in order to provide a solid foundation for practice (Chapter 11). In many respects, this is more of a problem today than in 2007 and we are concerned that the field is regressing vis-à-vis a reemergence of reliance on untested assumptions and superstition in identification, intervention, and remediation practices. Clinical experience is a fertile ground for hypothesis generation, but the inferences that emerge from experience must be empirically verified, particularly in identification practices and intervention. The issue remains: For whom do different factors converge to cause LDs, and how do different components of intervention relate to the various expressions of LDs?

Caveats

This edition has similar caveats to the first edition. We present a particular approach to understanding LDs, which is based on a classification with its roots in academic achievement and which we use to account for the heterogeneity of LDs. Academic deficits are necessary, but not sufficient, for a classification of LDs. However, without achievement as an anchor, it is difficult to validate the construct of LDs.

Accordingly, we do not review research on students broadly defined with LDs when the specific form of academic impairment is not indicated, unless that approach predominates in the instructional literature. In the absence of this type of specification, the samples included in such studies are too heterogeneous to determine valid relations with specific forms of LDs. Likewise, we do not review research suggesting that LDs involving social or executive functions should be separately

identified because we do not feel that such approaches to identification result in effective classifications of LDs. Although we recognize that other approaches to defining "verbal" and "nonverbal" LDs have represented major contributions to the field (e.g., Johnson & Myklebust, 1967; Rourke, 1989), we do not explicitly organize our approach around this dichotomy for definition and classification. The reader is encouraged to examine these approaches, such as the approach to the definition of "verbal" and "nonverbal" LDs developed by Rourke and colleagues (see *www.nld-bprourke.ca/index.html*) and addressed most recently by Cornoldi, Mammarella, and Fine (2016). There are major issues regarding the hypothesis of nonverbal LDs (Pennington, 2009; Spreen, 2011). These include specific diagnostic criteria, the fact that academic problems are not considered a defining characteristic, whether the characteristics are better accounted for by classifications stemming from ADHD or autism spectrum disorder, and the role of social skills. Etiological hypotheses involving differences in hemispheric distribution of white matter or problems involving the right hemisphere have not found consistent support. Renaming nonverbal LDs as right-hemisphere LDs or as visuospatial LDs seems to confuse the behavioral description with hypotheses about etiology. More research would be useful, but it is not a focus of our book and does not fit into our framework for understanding LDs.

Given the enormous volume and complexity of the literature on topics associated with treatment of and instruction for LDs, our review of relevant research is selective rather than exhaustive. It was not possible to systematically address research related to ADHD or to social and emotional difficulties—areas of development that are clearly problematic for many students with LDs. These influences are usually *comorbid,* representing frequently co-occurring difficulties as opposed to qualitatively disparate disorders. In terms of Figure 1.1, we do not provide an extensive discussion of the psychosocial and behavioral factors or a broad assessment of environmental factors (e.g., poverty) that impact the development of children with LDs (for a review, see Phillips & Lonigan, 2005). This is partly because there is little evidence that the phenotypic manifestations of academic difficulties vary by putative cause. We focus instead on intervention.

In our analysis of the literature, most psychosocial and environmental influences contribute to the severity of academic achievement problems, but do not produce qualitative variation; hence the importance of instructional response in operationalizing unexpected underachievement. Although various theoretical and conceptual models related to treatment are implicit in our review of interventions, as are specific intervention methods, we do not view the work emanating from these different sources and perspectives as necessarily contradictory and do not discuss these models in detail. Rather, thoughtful integration of these models is resulting in more efficacious interventions for individuals with different types of LDs. Academic therapies that involve substantial exposure to reading, mathematics, and writing are most effective; other approaches to interventions that teach cognitive or motor processes, train the brain, or focus on aspects of the disorder (e.g., vision) that are not directly tied to the academic skill do not result in improved outcomes for students with LDs. Further, the literature is replete with claims for instructional and treatment methods that are based on subjective, nonreplicated

clinical reports, testimonial information, and anecdotal statements on groups broadly defined with LDs. We have limited our discussion to empirical research.

Finally, we attempted to review research conducted internationally, but our focus on history and policy is narrowly focused on the U.S. We do not have sufficient access to policy formulations in other countries and sometimes lack access to the many excellent studies completed by our international colleagues, especially in the intervention area.

Even with these stipulations, the range of research covered in this book is broad, and there is wide variation in the quality of the studies and syntheses we have selected for discussion. We generally tried to select the strongest possible studies and syntheses for review. As we show in Chapter 2, the scientific basis for LDs continues to evolve and has expanded since the first edition of this book in 2007. LDs are unique among developmental disorders not only in the dramatic growth of knowledge across different domains, but also in the extent of vertical, cross-disciplinary integration that has occurred, especially for word-level disorders (Elliott & Grigorenko, 2014; Lyon & Weiser, 2013; Shavelson & Towne, 2002). In the future, we believe that this type of cross-disciplinary integration is essential to the development of a comprehensive model encompassing all forms of LDs, and we offer this second edition in anticipation of continued development of an integrated understanding of LDs.