
Learning Disabilities

G. Reid Lyon

G. Reid Lyon, Ph.D., is a psychologist and director of extramural research in learning disabilities, language disorders, and disorders of attention at the National Institute of Child Health and Human Development at the National Institutes of Health, Bethesda, MD.

Abstract

Approximately 5% of all public school students are identified as having a learning disability (LD). LD is not a single disorder, but includes disabilities in any of seven areas related to reading, language, and mathematics. These separate types of learning disabilities frequently co-occur with one another and with social skill deficits and emotional or behavioral disorders. Most of the available information concerning learning disabilities relates to reading disabilities, and the majority of children with learning disabilities have their primary deficits in basic reading skills.

An important part of the definition of LD is its exclusions: learning disabilities cannot be attributed primarily to mental retardation, emotional disturbance, cultural difference, or disadvantage. Thus, the concept of LD focuses on the notion of a *discrepancy* between a child's academic achievement and his or her apparent capacity to learn.

Recent research indicates, however, that disability in basic reading skills is primarily caused by deficits in phonological awareness, which is independent of any achievement-capacity discrepancy. Deficits in phonological awareness can be identified in late kindergarten and first grade using inexpensive, straightforward testing protocol. Interventions have varying effectiveness, depending largely on the severity of the individual child's disability.

The prevalence of learning disability identification has increased dramatically in the past 20 years. The "real" prevalence of LD is subject to much dispute because of the lack of an agreed-upon definition of LD with objective identification criteria. Some researchers have argued that the currently recognized 5% prevalence rate is inflated; others argue that LD is still underidentified. In fact, it appears that there are both sound and unsound reasons for the increase in identification rates.

Sound reasons for the increase include better research, a broader definition of disability in reading, focusing on phonological awareness, and greater identification of girls with learning disabilities. Unsound reasons for the increase include broad and vague definitions of learning disability, financial incentives to identify students for special education, and inadequate preparation of teachers by colleges of education, leading to overreferral of students with any type of special need.

There is no clear demarcation between students with normal reading abilities and those with mild reading disability. The majority of children with reading disabilities have relatively mild reading disabilities, with a smaller number having extreme reading disabilities. The longer children with disability in basic reading skills, at any level of severity, go without identification and intervention, the more difficult the task of remediation and the lower the rate of success.

Children with extreme deficits in basic reading skills are much more difficult to remediate than children with mild or moderate deficits. It is unclear whether children in the most severe range can achieve age- and grade-appropriate reading skills, even with normal intelligence and with intense, informed intervention provided over a pro-

tracted period of time. Children with severe learning disabilities are likely to manifest an increased number of and increased severity of social and behavioral deficits. When children with disabilities in reading also manifest attention deficit disorder, their reading deficits are typically exacerbated, more severe, and more resistant to intervention.

While severe reading disorders are clearly a major concern, even mild deficits in reading skills are likely to portend significant difficulties in academic learning. These deficits, too, are worthy of early identification and intervention. Even children with relatively subtle linguistic and reading deficits require the expertise of a teacher who is well trained and informed about the relationships between language development and reading development. Unfortunately, such teachers are in short supply, primarily because of a lack of professional certification programs providing this training.

This article focuses primarily on deficits in basic reading skills, both because of their critical importance to academic success and because relatively more is known about these deficiencies. However, other academic, social, and behavioral manifestations of learning disability are also important and cannot be assumed to be adequately addressed by programs to improve basic reading skills. While early intervention is necessary, it should not be assumed to be sufficient to address the multiple manifestations of learning disability.

Approximately one-half of all children receiving special education services nationally, or about 5% of the total public school population, are identified as having a learning disability (LD) when the federal definition of LD is used by schools to formulate identification criteria.¹ At the same time, LD remains one of the least understood and most debated disabling conditions that affect children. Indeed, the field continues to be beset by pervasive, and occasionally contentious, disagreements about the definition of the disorder, diagnostic criteria, assessment practices, treatment procedures, and educational policies.²⁻⁶

Learning disability is not a single disorder, but is a general category of special education composed of disabilities in any of seven specific areas: (1) receptive language (listening), (2) expressive language (speaking), (3) basic reading skills, (4) reading comprehension, (5) written expression, (6) mathematics calculation, and (7) mathematical reasoning. These separate types of learning disabilities frequently co-occur with one another and also with certain social skill deficits and emotional or behavioral disorders such as attention deficit disorder. LD is not synonymous with reading disability or dyslexia although it is frequently misinterpreted as such.^{7,8} However, most of the available information concerning learning disabilities relates to reading disabilities, and the majority of children with LD have their primary deficits in reading.²

Box 1 shows the statutory definition of learning disabilities contained in the Individuals with Disabilities Education Act (IDEA). An important part of

Box 1

Definition of Learning Disability Under the Individuals with Disabilities Education Act

“Specific learning disability” means a disorder in one or more basic psychological processes involved in understanding or in using language, spoken or written, that may manifest itself in an imperfect ability to listen, speak, read, write, spell, or to do mathematical calculations. The term includes such conditions as perceptual disabilities, brain injury, minimal brain dysfunction, dyslexia, and developmental aphasia. The term does not apply to children who have learning problems that are primarily the result of visual, hearing, or motor disabilities, of mental retardation, of emotional disturbance, or of environmental, cultural, or economic disadvantage.

Source: *Code of Federal Regulations*, Title 34, Subtitle B, Chapter III, Section 300.7(b)(10).

the definition of learning disabilities under the IDEA is the exclusionary language: learning disabilities cannot be attributed primarily to mental retardation, emotional disturbance, cultural difference, or environmental or economic disadvantage. Thus, the concept of learning disabilities embedded in federal law focuses on the notion of a discrepancy between a child’s academic achievement and his or her apparent capacity and opportunity to learn. More succinctly, Zigmond notes that “learning disabilities reflect unexpected learning problems in a seemingly capable child.”⁹

Although poverty and disability are often found together and each tends to exacerbate the other (see the article by Wagner and Blackorby in this journal issue), Congress has established separate programs to serve children with disabilities (the IDEA) and children in poverty (Title I). Title I of the Elementary and Secondary Education Act provides funding for supplemental programs in schools serving large numbers of economically disadvantaged children. Because individual children with disabilities have strong entitlements to services under the IDEA, Congress’s intent was that the IDEA serve only children with “true disabilities” and that the IDEA specifically exclude those students whose underperformance is primarily attributable to poverty. However, in the category of learning disability, and perhaps also in the category of mental retardation, this distinction is difficult or impossible to draw, and no empirical data exist to support this exclusionary practice.

While there is some agreement about these general concepts, there is continued disagreement in the field about diagnostic criteria, assessment practices, treatment procedures, and educational policies for learning disabilities. A number of influences have contributed to these disagreements which, in turn, have made it difficult to build a generalizable body of scientific and clinical knowledge about learning disabilities and to establish reliable and valid diagnostic criteria.^{4,5} While some progress has been made during the past decade in establishing more precise definitions and a theoretically based classification system for LD,^{8–10} it is useful to understand these historical influences because of their continuing impact on diagnostic and treatment practices for children with learning disabilities.

The next section of this article reviews briefly the historical events that have molded the field of learning disabilities into its present form. Subsequent sections address issues related to the prevalence of learning disabilities, the validity of current prevalence estimates, impediments to the identification and teaching of the child with LD, advances in identification, classification, intervention practices in the area of reading disability, comorbidity of types of learning disabilities (reading, written expression, mathematics disabilities) with disorders of attention and social skills deficits, outcomes for individuals with learning disabilities, and the implications for teacher preparation and school policies.

Historical Influences

The study of learning disabilities was initiated in response to the need (1) to understand individual differences among children and adults who displayed *specific* deficits in spoken or written language while maintaining integrity in *general* intellectual functioning and (2) to provide services to these students, who were not being adequately served by the general educational system.^{6,9,10} Overall, the field of learning disabilities emerged primarily from a social and educational need and currently remains a diagnostic practice that is more rooted in clinical practice, law, and policy than in science. Advocates for children with learning disabilities have successfully negotiated a special education category as a means to educational protection at the same time that the schools have seen an increase in the identification of LD.⁶

The unexpected pattern of *general* strengths and *specific* weaknesses in learning was first noted and studied by physicians during the early twentieth century, thus giving the field its historical biomedical orientation.¹⁰ Doctors noted that children with learning disabilities were similar to adults and children with focal brain damage in that specific impairments in some areas of learning could occur without diminishing strengths in general cognitive ability.

Although the clinical work conducted during the first half of the twentieth century recognized the existence of learning disabilities, such information had little influence on public school policies until the mid-1960s. At this time, behavioral scientists, educators,¹¹ and parents expressed concern that some children had learning handicaps that were not being served effec-

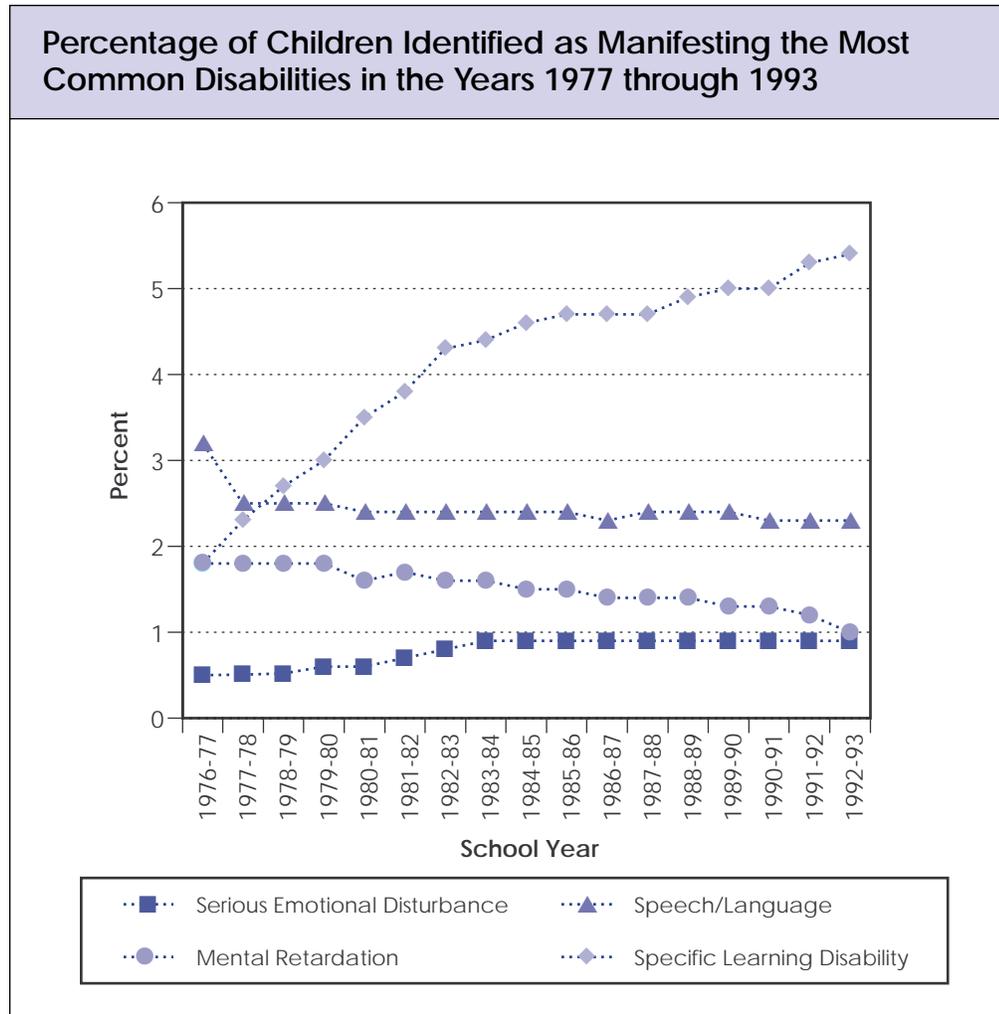
tively by general educational practices.⁹ At the same time, these children were ineligible for special education services because their characteristics did not correspond to any recognized categories of disability. This disenfranchisement stimulated an advocacy movement to provide special educational services to students with learning disabilities,^{4,6,9} leading many states to establish a special education category for LD during the late 1960s and 1970s.

Prevalence

The influence of advocacy has, in turn, contributed to a substantial proliferation in the number of children who have been identified with learning disabilities relative to other handicapping conditions (see Figure 1). Clearly, the prevalence of LD identification has increased dramatically.

The “real” prevalence of learning disabilities is subject to much dispute because of the lack of an agreed-upon definition of LD and objective diagnostic criteria.^{4,8,12} Some have argued that the currently recognized 5% prevalence rate is excessive and is based on vague definitions, leading to inaccurate identification. On the other hand, research efforts to identify objective early indicators of LD in basic reading skills have concluded that virtually all children scoring below the 25th percentile on standardized reading tests can meet the criteria for having a reading disorder.¹² While less is known about LD in written expression, researchers estimate its true prevalence at between 8% and 15% of the school population.¹³ Research also indicates that approximately 6% of the school population has difficulties in mathematics which cannot be attributed to low intelligence, sensory deficits, or economic deprivation.¹⁴

Figure 1



Source: Office of Special Education Programs. *Implementation of the Individuals with Disabilities Education Act: Fifteenth Annual Report to Congress*. Washington, DC: U.S. Department of Education, 1993.

Increase in Identification

The substantial increase in the identification of children with learning disabilities shown in Figure 1 has led many to question the validity and reliability of LD as a diagnostic category or its “realness” as a handicapping condition.¹⁵ In fact, it appears likely that there are both sound and unsound reasons for the increase, as is discussed later.

It should be made clear that difficulties in the identification of children with learning disabilities do not make the disabilities any less “real” to the student who cannot learn to read, write, or understand mathematics despite good intelligence, an adequate opportunity to learn, and ostensibly good teaching. However, such an anecdotal understanding of learning disability and its prevalence seems inadequate now, given the increase in diagnoses of LD, the conse-

quences of learning failure in children, and the tremendous financial resources that are applied to the identification and teaching of children with learning disabilities. Given what is at stake, it is critical that the construct of learning disability and procedures for identifying children and adults with LD be valid and accepted by the scientific and clinical communities.

The question remains, however, of how to go about increasing the ability to identify individuals with LD accurately. Valid prevalence estimates depend upon a set of criteria for identification that are clear, observable, measurable, and agreed upon.

The Discrepancy Standard

There is currently no universally accepted test, test battery, or standard for identifying children with LD. While a discrepancy

between intelligence quotient (IQ) and achievement has been a widely accepted criterion for the identification of LD and still serves as the driving clinical force in the diagnosis of LD, there is considerable variation in how the discrepancy is derived and quantified.^{9,16} Federal regulations and extant clinical criteria¹⁷ do not specify particular formulas or numerical values to assess discrepancy objectively. The effect of this lack of specification on both clinical and research practices is substantial. From a clinical standpoint, a child can be identified as having a learning disability in one school district but not in a neighboring district because of differences in the measure of discrepancy used. From a research perspective, different approaches to the discrepancy measurement lead to substantially different sample characteristics and different prevalence estimates, which undermine the ability to replicate and generalize findings.^{5,6,8,9}

For the individual child, use of the discrepancy standard clearly promotes a wait-to-fail policy because a significant discrepancy between IQ and achievement generally cannot be detected until about age eight or nine. In fact, most school districts do not identify children with learning disabilities until a child is reading well below grade level, generally in third or fourth grade.¹⁸ By this time the child has already experienced at least a few years of school failure and probably has experienced the common attendant problems of low self-esteem, diminished motivation, and inadequate acquisition of the academic material covered by his classmates during the previous few years.

It is clear that the longer children with learning disabilities, at any level of severity, go without identification and intervention, the more difficult the task of remediation becomes and the harder it is for the children to respond. Specifically, the data strongly suggest that children at risk for reading failure should be identified before the age of nine if successful intervention results are to be anticipated.¹³ For example, a longitudinal investigation of 407 students¹⁹ found that 74% of the children whose disability in reading was first identified at nine years of age or older continued to read in the lowest quintile throughout their middle and high school years. In addition, the longer children, at all severity levels, are faced with fail-

ure in reading in the classroom setting, the greater the probability that comorbid learning and behavioral difficulties will arise, further complicating the remediation task.

Developing a Diagnostic Standard

If current definitions of learning disability are not useful and if the discrepancy standard is a poor one, why have schools not adopted other means of defining and identifying LD? There are a number of conceptual and methodological barriers to the accurate identification of learning disabilities, and these impediments lead to confusion about definitions, diagnostic issues, and rising prevalence rates.

Multidisciplinary Nature of the Field

Opinions about what constitutes a learning disability vary^{6,10} in part because LD is the concern of many disciplines and professions, including education, psychology, neurology, neuropsychology, optometry, psychiatry, and speech and language pathology, to name a few. Each of these disciplines has traditionally focused on different aspects of the child or adult with learning disability, so divergent ideas and contentious disagreements exist about the importance of etiology, diagnostic methods, intervention methods, and professional roles and responsibilities.¹⁰ It is not surprising that so many children are identified because each professional may view the child through his or her own idiosyncratic clinical lens. For example, optometrists may identify a child as having a learning disability if the youngster displays difficulties in visual tracking. Speech and language pathologists, on the other hand, become concerned if the child's vocabulary and syntactic development are not commensurate with expectations. Educators become concerned primarily when development in reading, writing, and mathematics is deficient.

Lack of Specific Identification Criteria

Probably the most significant and persistent problem in the field is the lack of a precise definition and a theoretically based classification system that would allow (1) the identification of different types of learning disabilities and (2) a means of recognizing distinctions and interrelationships between types of learning disabilities and other learning disorders such as mental retardation, attention deficit disorder, speech and lan-

guage difficulties, and general academic underachievement.²⁰ At present, the field continues to construct and use vague and ambiguous definitions that rely heavily on the exclusion of alternative diagnoses, such as the IDEA definition shown in Box 1.

Overly Broad Label

Some observers argue that the term “learning disability” is too broad to be of any diagnostic value. Stanovich,¹⁶ a leading proponent of this view, proposes that the general term learning disabilities be abandoned and that definitional and research efforts focus on the specific types of disabilities that are now identified in ambiguous terms.

As noted earlier, the generic term learning disabilities encompasses disabilities in seven categories: (1) listening, (2) speaking, (3) basic reading skills, (4) reading comprehension, (5) written expression, (6) mathematical calculation, and (7) mathematical reasoning. Given the complexity and heterogeneity of each of these disabilities, it seems unrealistic to expect that any definitional clarity can be achieved by grouping them together under one label. To do so only obscures the critical features of each disability and makes research findings difficult to interpret.

Definitions of specific learning disabilities can be more easily and successfully operationalized than generic definitions, as the research on disability in basic reading skills shows.⁸ To establish valid prevalence estimates for the number of individuals with learning disabilities, the first step should be to establish explicit diagnostic criteria for *each* of the seven specific disability domains. At present, the greatest progress toward this goal has been in the area of disability in basic reading skills.⁸

LD as a Sociological Phenomenon

The simplest explanation for the increasing numbers of children identified with learning disabilities and for the difficulty in understanding and defining LD is that “LD” is not a distinct disability, but an invented category created for social purposes. Some argue that the majority of students identified as having learning disabilities are not intrinsically disabled but have learning problems because of poor teaching, lack of educational opportunity, or lim-

ited educational resources.¹⁵ In addition, because the label of LD is not a stigmatizing one, parents and teachers may be more comfortable with a diagnosis of LD than with labels such as slow learner, minimal brain dysfunction, or perceptual handicap. A diagnosis of LD does not imply low intelligence, emotional or behavioral difficulties, sensory handicaps, or cultural disadvantage. Thus, more positive outcomes are expected for children with learning disabilities than for those with mental retardation or emotional disturbance.

Reasons for Increase in Identification of LD

As pointed out, the substantial increase in the identification of LD, as shown in Figure 1, has caused many researchers to question the validity of the data. No doubt, the failure to develop an agreed-upon, objective, operational definition of learning disability gives credence to the concern about the validity of the identification process. Thus, it seems reasonable to assume that at least some of the increase in prevalence can be linked to conceptual, methodological, social, and political factors that spuriously inflate the identification of children with learning disabilities.⁵ However, despite the conceptual and methodological shortcomings that have plagued the field with respect to definition and identification practices, there exist a number of possibly sound reasons that could account for an increase in the number of children identified with LD.

Some Sound Reasons

As knowledge about learning disabilities grows, some academic difficulties not previously recognized as LD can be identified as such. Greater knowledge also affects the behavior and practices of teachers and parents. Sound reasons for the increase in identification rates are described and discussed in the sections that follow.

■ *Better Research.* Research in the past decade measures underachievement in reading as it occurs naturally in large population-based samples^{12,13} rather than as identified by schools, which use widely varying criteria. In addition, much of this new research is longitudinal and has been replicated, providing the necessary foundation for epidemiological studies.^{2,12,13,19,21–24} Finally, many of these



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studies have been specific to LD in reading, rather than LD in general, allowing greater precision.

■ *Broader Definitions.* Prevalence is directly linked to definition. LD in reading has been defined in recent research as *significant difficulties in reading single words accurately and fluently, in combination with deficits in phonological awareness.*⁸ Using this definition and stronger longitudinal research methods outlined above, the prevalence for reading disability alone has increased from estimates of less than 5% in 1976 to approximately 17% in 1994.¹²

Phonological awareness is a critical attribute in learning to read, and children who lack this awareness can be identified in late kindergarten and early first grade. Typical diagnostic questions for kindergartners or first graders involve rhyming skills (for example, “Tell me three words that rhyme with ‘cat’”) and phoneme deletion skills (for example, “Say ‘cat’ without the /t/ sound”). The majority of children pick up phonological awareness skills easily by six to seven years of age, but a large minority of children (about 17%) have significant difficulty with these skills and will have great difficulty learning to read, regardless of their intelligence, unless these skills are acquired.

■ *Identification of LD in Girls.* A substantial portion of this increase can be attributed to the fact that females have been found to manifest reading disabilities at rates equal to males, in contrast to previous reports that males with reading disabilities outnumbered females with reading disabilities at a ratio of four to one.²⁵ This finding necessarily increases the prevalence rate.

■ *Increased Awareness.* Information disseminated in the past decade, particularly concerning the characteristics of reading disability, has increased the number of children referred for assessment of a learning disability.⁶

■ *Understanding of the Impact.* There has been an increase in the recognition that even “mild” deficits in reading skills are likely to portend significant difficulties in academic learning and are, therefore, worthy of early identification, diagnosis, and intervention.^{26,27}

Some Unsound Reasons

There is no shortage of horror stories about the misidentification of LD and reports that the category serves as a “catch all” for any youngster who is not meeting the expectations of parents and teachers. Are there legitimate reasons for these criticisms? The

answer appears to be yes. Examples are described and discussed in the sections that follow.

■ *Ambiguous Definitions.* The ambiguity inherent in the general definitions of LD (see Box 1) leaves the identification process open for wide interpretation and misinterpretation. Flexible identification decision making allows some children to be identified as having learning disabilities when they do not, while others with learning disabilities may be overlooked.⁵ This latitude can be manipulated to increase prevalence rates in response to financial incentives (for example, to qualify for increased state funding), to decrease prevalence rates in response to political movements (for example, inclusion), or to abandon programs that appear too costly.²⁸

■ *Social and Political Factors.* Social and political factors also contribute to the inflation of prevalence rates for learning disabilities. In 1976–77, the first year of full implementation of Public Law 94–142, 2.16% of all schoolchildren were served in programs for chil-

and measures to the assessment task. Inconsistent identification practices allow prevalence rates to escalate. This is a significant problem when there are financial incentives to encourage identification (see the article by Parrish and Chambers in this journal issue). Both market and legal forces can stimulate the development of new professional specialties (such as language/learning disorder specialist) whose members have financial incentives to diagnose students with learning disabilities, which the specialists will often be employed to treat. Although it may be uncomfortable to mention these factors, they exist and play some role in the increase of prevalence of LD. At the same time, the majority of professionals serving children with learning disabilities appear well intentioned and well informed.

■ *Inadequate Preparation of Teachers.* Unfortunately, a major factor contributing to invalid prevalence estimates may be the inadequate preparation of teachers by colleges of education. Recent studies have found that a majority of regular classroom teachers feel that they are not prepared to address individual differences in learning abilities within classroom settings.²⁹ Even more alarming, research suggests that special educators themselves do not possess sufficient content knowledge to address the language and reading needs of children with learning disabilities.³⁰ Without adequate preparation, teachers have a tendency to overrefer children for specialized assistance because they feel ill-equipped to provide the necessary services.³¹

Both market and legal forces can stimulate the development of new professional specialties whose members have financial incentives to diagnose students with learning disabilities.

dren with mental retardation (MR) and 1.80% in programs for children with learning disabilities (Figure 1). By the 1992–93 school year, placements for children with MR had decreased to 1.1% while placements for children with LD had increased to 5.4% of the total school population (Figure 1). While these reversed trends mask substantial variations among states, the dramatic changes in identification rates of the two types of disability suggest that attempts to apply less stigmatizing labels may be influencing the identification process.

■ *Number of Professional Specialties Involved.* The large number of professional specialties involved in the identification process provides fertile ground for the overidentification of LD because each specialty brings its own set of diagnostic assumptions, theories,

Interpreting Prevalence Rates

The prevalence of learning disabilities is completely dependent upon the definition used. In most areas, the identification of LD is based largely upon the discrepancy standard and, thus, provides a count of the number of older elementary students (third grade and above) who are achieving significantly below expectations based on IQ. This is, at best, an incomplete definition of LD and one that, for the majority of students with learning disabilities, is based upon an invalid criterion, namely, the discrepancy standard.

Clearly, current definitions allow both overidentification and underidentification of LD. Depending upon the magnitude of

financial incentives and upon unrelated factors (for example, class size, goals for increasing test scores) that often shape the decisions of classroom teachers to refer students with special needs, an individual school district may drastically overidentify or underidentify students with learning disabilities. Therefore, local or national statistics on identification rates for students with LD must be interpreted with caution.

Efforts to Improve Identification

To improve the diagnosis and remediation of learning disabilities, a classification system is needed to identify different types of learning disabilities as well as the distinctions and interrelationships among types of LD and other childhood disorders.^{2,20,32} Prospective longitudinal studies are one of the most powerful means to study the different types of LD and their relationships to other disorders and to obtain data for a focused and succinct definition.

Prospective, longitudinal studies of LD can serve as a platform to (1) identify critical learning and behavioral characteristics that may be manifested in different ways at different developmental periods, (2) develop early predictors of underachievement for different academic domains (for example, reading, written language, math), (3) map the developmental course of different types of learning disabilities, (4) identify commonly co-occurring disorders and secondary behavioral consequences that develop in response to failure in school, and (5) assess the efficacy of different treatment and teaching methods for different types of learning disabilities.

To address this compelling need to establish a valid classification system and definition for LD, Congress enacted the Health Research Extension Act of 1985 (Public Law 99-158). This act called for the development of an Interagency Committee on Learning Disabilities (ICLD), under the lead of the National Institute of Child Health and Human Development (NICHD), to identify critical research needs in LD and to implement comprehensive studies to address issues relevant to identification, prevention, etiology, and treatment.

New Knowledge of Reading Disabilities

Since the inauguration of the NICHD Learning Disability Research Network in 1987, researchers have learned the most about learning disabilities that affect linguistic, reading, and spelling abilities and the least about learning disabilities in mathematics.² A number of new findings have also been obtained in the area of attention deficit disorder (ADD) and its relationship to dif-

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ferent types of LD, particularly disorders in reading.¹² For brevity, the major discoveries made during the past several years are presented in Table 1. Selected findings are reviewed here. The reader should note that many findings have been replicated by multiple research groups, as cited in Table 1, and that the findings are primarily based on large longitudinal samples. Finally, readers should note that studies being conducted in Canada by Stanovich and Siegel at the Ontario Institute for Studies in Education are included in Table 1 because of their impact on the field and because Stanovich and Siegel serve as consultants to the Yale Learning Disability Research Center (LDRC).

As Table 1 shows, a majority of discoveries made during the past decade have been in the area of reading disabilities. This is appropriate. As Lerner pointed out from her analysis of public school referral data in 1989,³³ approximately 80% of children identified as having learning disabilities have their primary difficulties in learning to read. This high rate of occurrence of reading difficulties among youngsters with LD has also been reported by Kavale in his meta-analytic studies.³⁴ More recent longitudinal and cross-sectional studies have supported the high rate of reading difficulty among children with learning disabilities, but have also found that reading deficits frequently co-occur with other academic and attentional difficulties. For example, Fletcher and his associates at the Yale Center for the Study of Learning and Attention have, as part of a

Table 1

Major Findings from Research Programs Supported by the National Institute of Child Health and Human Development		
Research Domain	Findings	Research Group*
Definition of learning disabilities	Definitions that measure the discrepancy between IQ and achievement do not adequately identify learning disabilities, particularly in the area of basic reading skills.	Yale Ontario
Reading processes	Disabled readers with and without an IQ-achievement discrepancy show similar information processing, genetic, and neurophysiological profiles. This indicates that the existence of a discrepancy is not a valid indicator of disability in basic reading skills.	Colorado Bowman Gray Yale Ontario
Reading processes	Epidemiological studies indicate that as many females as males manifest dyslexia; however, schools identify three to four times more boys than girls.	Bowman Gray Colorado Yale
Reading processes	Reading disabilities reflect a persistent deficit rather than a developmental lag. Longitudinal studies show that, of those children who are reading disabled in the third grade, approximately 74% continue to read significantly below grade level in the ninth grade.	Yale Ontario
Reading processes	Children with reading disability differ from one another <i>and</i> from other readers along a continuous distribution. They <i>do not</i> aggregate together to form a distinct “hump” separate from the normal distribution.	Yale Bowman Gray Colorado Ontario
Reading processes	The ability to read and comprehend depends upon rapid and automatic recognition and decoding of single words. Slow and inaccurate decoding are the best predictors of deficits in reading comprehension.	Yale Bowman Gray Colorado Johns Hopkins Florida Houston
Reading processes	The ability to decode single words accurately and fluently is dependent upon the ability to segment words and syllables into phonemes. Deficits in phonological awareness reflect the core deficit in dyslexia.	Yale Colorado Bowman Gray Miami Johns Hopkins Florida Houston
Reading processes	The best predictor of reading ability from kindergarten and first-grade performance is phoneme segmentation ability.	Bowman Gray Yale Florida Houston
Attention	A precise classification of disorders of attention is not yet available; however, operational definitions are emerging.	Yale
Attention	Approximately 15% of students with reading disability also have a disorder of attention. Approximately 35% of students with disorders of attention also have reading disability. However, the two disorders are distinct and separable.	Bowman Gray Yale

*See the related endnote at the end of this article for a detailed description of research groups.

Table 1 (continued)

Major Findings from Research Programs Supported by the National Institute of Child Health and Human Development		
Research Domain	Findings	Research Group*
Attention	Disorders of attention exacerbate the severity of reading disability.	Bowman Gray Miami
Genetics	There is strong evidence for a genetic basis for reading disabilities, with deficits in phonological awareness reflecting the greatest degree of heritability.	Colorado Bowman Gray
Neurology	Regional blood studies indicate that deficient word recognition skills are associated with less than normal activation in the left temporal region.	Bowman Gray
Neurology	PET studies indicate that dyslexic adults have greater than normal activation in the occipital and prefrontal regions of the cortex.	Miami
Intervention	Disabled readers do not readily acquire the alphabetic code because of deficits in phonological processing. Thus, disabled readers must be provided highly structured programs that explicitly teach application of phonological rules to print.	Bowman Gray Florida Houston
Intervention	Longitudinal data indicate that systematic phonics instruction results in more favorable outcomes for disabled readers than does a context-emphasis (whole language) approach.	Bowman Gray Florida Houston

*See the related endnote at the end of this article for a detailed description of research groups.

larger classification effort, studied 216 children, 7.5 to 9.5 years of age, who were identified as normal readers, reading disabled, math disabled, both reading and math disabled, normal reading with ADD, and reading disabled with ADD.^{21,35} From this sample of children with a variety of learning disabilities, only 25 youngsters were reading at age-appropriate levels.

Research indicates that reading disorders reflected in deficient decoding and word-recognition skills are primarily caused by deficiencies in the ability to segment syllables and words into constituent sound units called phonemes.^{16,22,36-38} For example, in a large study of 199 seven- to nine-year-old children who had significant difficulties in decoding and word recognition, more than 85% of the youngsters manifested deficits on measures of phonological awareness. In this investigation, children with and without IQ-reading-achievement discrepancies appeared equally impaired on both the phonological and reading measures.²¹ This extremely high frequency of

phonological awareness deficits in children with reading disabilities has led Share and Stanovich to conclude: "We know unequivocally that less-skilled readers have difficulty turning spellings into sounds. . . . This relationship is so strong that it deserves to be identified as one, if not the defining, feature of reading disability."³⁹

Biological Bases

Several NICHD investigations have indicated that these phonologically based reading disabilities are linked to neurobiological and genetic factors.^{2,8,13,40} Functional and structural neuroimaging studies indicate that the poor phonological skills, which limit the development of basic reading abilities, are highly related to aberrant neurophysiological processing.^{22,40} Moreover, there is increasing evidence from behavioral and molecular genetic studies that the phonological deficits observed in reading disability are heritable.^{41,42} Taken together, longitudinal studies of the linguistic, neurobiological, and genetic factors in reading disabilities provide strong and converging

evidence that reading disability is primarily caused by deficits in phonological processing and, more specifically, phonological awareness.^{8,13,30,37,38,40}

Likewise, the data derived from genetic and neurobiological studies suggest that some reading disabilities are associated with subtle chromosomal⁴² and neurological differences,^{22,40} indicating that such disabilities are biologically “real” rather than sociopolitically created.

Discrepancy Standard

In addition to the previously discussed problems of the discrepancy standard, Table 1 indicates that the use of a discrepancy formula, which calculates differences between IQ and reading scores, is not a valid indicator of reading disability; that is, children with reading disabilities both with and without such discrepancies have similar deficits in phonological awareness and similar genetic and neurophysiological characteristics.³⁶ At this time, it is not clear whether children with higher IQs respond more favorably to intervention.⁷

Persistent Deficit

Unfortunately, as Table 1 indicates, reading disabilities appear to reflect a persistent deficit rather than a developmental lag. That is, children with delays in understanding phonological concepts in first grade are

self-concept. Instructional difficulties in later intervention abound. For example, the teacher carrying out the interventions may not be properly trained, the interventions may not include explicit and informed instruction in the development of phonological awareness and sound-symbol relationships, the interventions may not be consistently applied and/or may be limited in intensity and duration, and there may be insufficient follow-up or explicit instruction to enable the student to generalize the specific concepts learned to material presented in regular classroom settings.

Distribution of Severity

A significant finding from the Yale LDRC is that reading disability represents the extreme of a normal distribution of reading ability so that there is an unbroken continuum from reading ability to reading disability.⁴³ The finding that reading disability is part of a continuum now places the disorder in the context of other biologically based disorders such as hypertension and obesity.⁴³ The discovery that reading disability is best conceptualized as occurring along a normal distribution of reading skills underscores the fact that children will vary in their level of severity of the disorder running along a mild-to-severe spectrum, with the majority of children with reading disabilities falling at the mild end. This finding has significant implications. For example, what are the criteria for identifying a child as having a *severe* reading disability, and does this degree of disability warrant entitlement to a greater intensity and duration of specialized interventions?

To answer such questions, the NICHD is embarking on a series of studies to identify the most valid points along the distribution of reading scores that distinguish levels of severity. In part, the validity of different cut-off points for mild, moderate, and severe reading disability is being determined by how children in each severity group respond to different types and intensities of intervention. At this writing, some initial results derived from the Florida State Intervention Project show that children with scores at the extreme lower end of the distributions for both phonological awareness skills and basic reading skills are much more difficult to remediate than children who fall along the distribution in the mild and moderate

Interventions applied after a child has failed in reading for two or three years may not be effective for several reasons, including the student's declining motivation and impaired self-concept.

unlikely to catch up later without explicit and informed teaching. Longitudinal studies show that, of the youngsters who are identified in the third grade, approximately 74% remain reading disabled through the ninth grade.^{19,43} This appears to be true even when special education has been provided. It should be made clear, however, that interventions applied *after* a child has failed in reading for two or three years may not be effective for several reasons, including the student's declining motivation and impaired

ranges.⁴⁴⁻⁴⁶ It is as yet unclear whether children in the more severe range can achieve age- and grade-approximate reading skills, even with intense, informed intervention provided over a protracted period of time.

While children with severe reading disabilities will most likely require a greater amount of time in high-impact intervention programs than children with less severe deficits, as discussed earlier, it is clear that the longer children *at any level of severity* go without proper identification and intervention, the more difficult the task of remediation and the harder it becomes for the children to respond. It is also clear that even children with relatively subtle linguistic and reading deficits require the expertise of a teacher who is well trained and informed about the relationships between language development and reading development.³⁰ Unfortunately, such teachers are in short supply, primarily because of a lack of programs providing this training.³¹

Co-occurring Disorders

As noted, most children with learning disabilities have more than one of the seven subtypes of learning disabilities. It is also not unusual to find LD co-occurring with certain behavioral or emotional disorders. The most common co-occurring combinations are discussed briefly below.

Reading and Attention Disorders

Attention deficit disorder (ADD) is an increasingly common diagnosis recognized in medicine⁴⁷ and psychology¹⁷ although it is not a category of disability recognized under the IDEA. Like LD, ADD is the subject of considerable controversy, and diagnostic criteria for ADD continue to evolve. There is no litmus test for ADD, which is diagnosed on the basis of persistent and maladaptive behavior patterns (inattention, impulsivity, and hyperactivity) that are inappropriate for the child's age. The number of diagnoses of ADD has increased dramatically in the past decade,⁴⁸ and one study¹² found 7% of a survey sample of 445 kindergarten students qualifying as "inattentive" on the Multigrade Inventory for Teachers.

Figure 2¹² indicates that a child identified with reading disabilities is twice as likely as a member of the general population to also meet the diagnostic criteria for inattention

(15% versus 7%). Similarly, an individual diagnosed with ADD is at higher risk than a member of the general population of having a reading disability/phonological awareness deficit (36% versus 17%). Despite this co-occurrence, recent studies have indicated that reading disabilities and ADD are distinct and separable disorders.^{12,22,49}

Unfortunately, when children with disabilities in reading also manifest ADD, their reading deficits are typically exacerbated, more severe, and more resistant to intervention.²² In contrast to reading disabilities, ADD is more prevalent in males. Given the frequent co-occurrence of ADD with reading disabilities and given the tendency of

Even children with relatively subtle linguistic and reading deficits require the expertise of a teacher who is well trained.

boys with ADD to attract considerable attention from teachers, this combination may make boys with disabilities in reading much more likely than girls with disabilities in reading to come to the attention of teachers and to be referred for testing.

Social Adjustment Problems

In a broad sense, data indicate that learning disability, no matter what the specific type, has a tendency to co-occur with social adjustment problems.⁵⁰ Bruck,⁵¹ in her review of the literature related to social and emotional adjustment, concluded that children with learning disabilities are more likely to exhibit increased levels of anxiety, withdrawal, depression, and low self-esteem compared with their nondisabled peers. This comorbidity is persistent. For example, Johnson and Blalock⁵² found that, of the 93 adults studied in an LD clinic sample, 36% continued to receive counseling or psychotherapy for low self-esteem, social isolation, anxiety, depression, and frustration. In many instances, it appears that such emotional problems reflect adjustment difficulties resulting from academic failure.¹³ Deficits in social skills have also been found to exist at significantly high rates among children with learning disabilities.⁵³ In general, social skill deficits include difficulties interacting with people in an appropriate fashion (for

example, lack of knowledge of how to greet people, how to make friends, and how to engage in playground games or a failure to use knowledge of such skills in these situations). While not all children with learning disabilities exhibit deficits in social skills, there are certain common characteristics among those who do. For example, Bruck⁵¹ reported that children with more severe manifestations of LD are likely to manifest both an increased number of and increased severity of social skills deficits. Moreover, the gender of the child appears to be a factor, with evidence suggesting that girls with LD are more likely to have social adjustment problems.⁵¹

Reading Disorders with Other Learning Disabilities

There is abundant evidence that it is rare for a child with learning disabilities to manifest only one specific type of learning disability.^{3,53} The co-occurrence of learning disorders should be expected given the developmental relationships between listening, speaking, reading, spelling, writing, and mathematics. For example, it is clear that deficits in phonological awareness lead to difficulties in decoding and word recognition which, in turn, lead to deficits in reading comprehension.^{16,37,38} Likewise, children with disabilities in reading frequently experience persistent difficulties in solving word problems in math for the obvious reason that the printed word is difficult for them to comprehend.¹⁴

An important conclusion to draw from the literature on co-occurring disorders is that any intervention or remediation effort must take into account the range of deficits a child may have. More specifically, while an intensive reading intervention may consist of explicit instruction in phonological awareness, sound-symbol relationships, and contextual reading skills, the child may also require elements essential to bolstering self-esteem, and to fostering reading in other content areas such as mathematics, social studies, and science. One cannot expect the intervention for the reading deficit to generalize serendipitously to other domains of difficulty.

LD in Written Expression

Typically, children who display LD in written expression have difficulties in spelling,

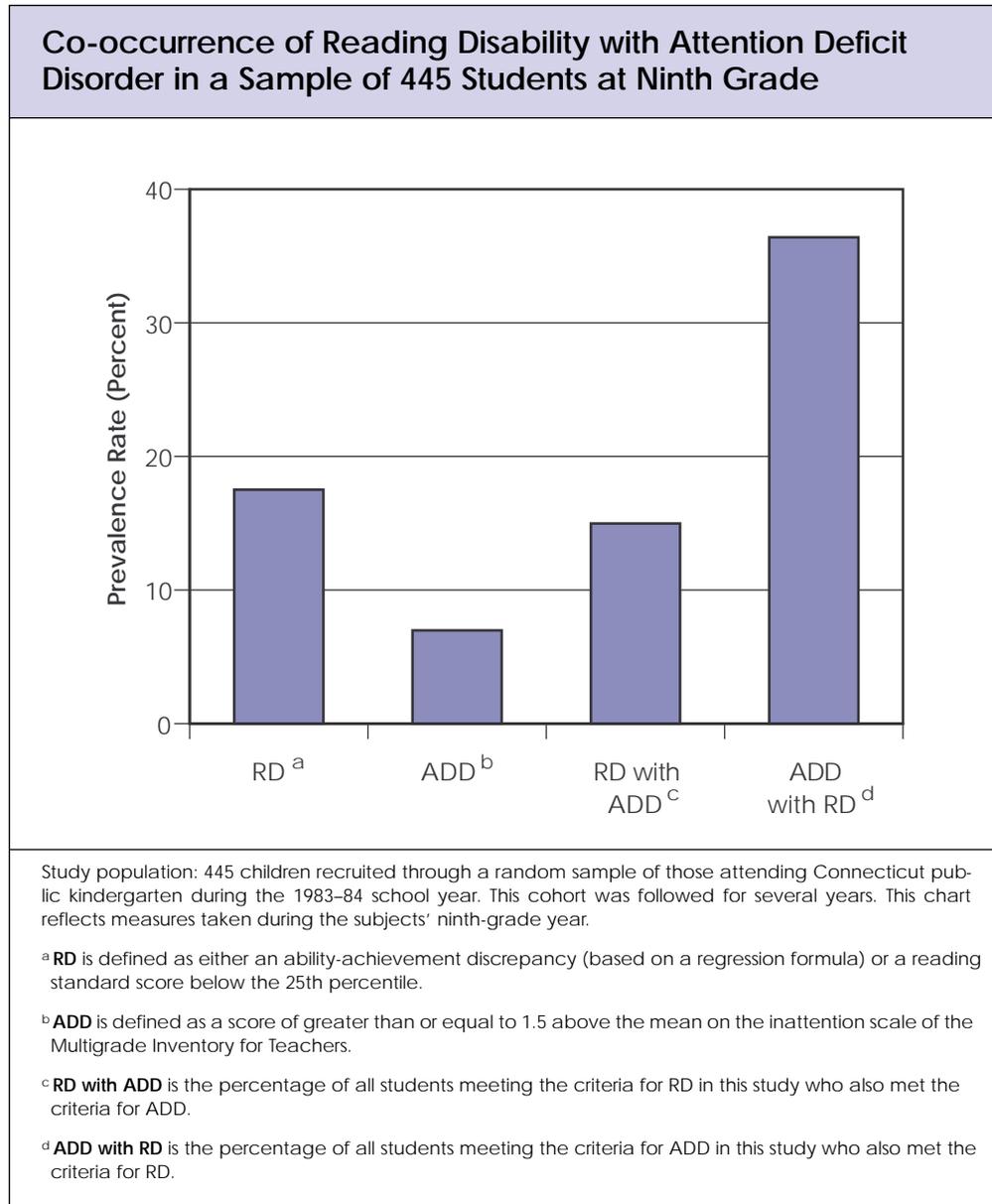
formulation and expression of ideas, handwriting, and knowledge of grammar and syntax. Unfortunately, well-designed research investigating disorders of written expression is relatively meager. Definitions for disorders of written expression remain vague.⁵⁴ Therefore it is not surprising that estimates of the prevalence of such disorders range from 8% to 15%.¹³ What is known is that boys and girls display written language deficits at relatively equal rates.⁵⁴ Despite the lack of objective and detailed identification criteria, a number of excellent studies have been conducted to identify effective assessment and intervention programs for problems in written expression.⁵⁵⁻⁵⁷

The most successful programs tend to ensure that clear linkages are drawn between oral language, reading, and written language. Successful programs also ensure that basic skills development in spelling and writing (graphomotor production) are explicitly taught and/or accommodated and that the student is also taught how to employ strategies to guide the formulation of ideas for writing and the organization of these ideas in writing. These elements are common to many writing programs; however, successful instruction for students with disabilities in written expression depends upon their intensity and explicitness.

LD in Mathematics

Children identified as manifesting LD in mathematics can demonstrate deficits in arithmetic calculation, mathematics reasoning, or both. In general, authorities agree that approximately 6% of the school population have difficulties in mathematics that cannot be attributed to low intelligence, sensory deficits, or economic deprivation.^{14,58} While the data are sparse at this time, it appears that deficits in arithmetic calculation skills are more frequently identified than deficits in arithmetic reasoning.¹⁴ However, common sense would suggest that attempts to reason mathematically would be constrained by limitations in calculations skills. Unfortunately, a major difficulty in identifying math learning disabilities accurately is that, like learning to read, learning mathematics concepts is dependent upon the teacher's knowledge of the concepts and ability to present them.¹³

Figure 2



Source: Adapted with permission from Shaywitz, S.E., Fletcher, J.M., and Shaywitz, B.A. Issues in the definition and classification of attention deficit disorder. *Topics in Language Disorders* (1994) 14:1–25.

Interventions for Learning Disabilities

Space does not permit an extended review of research on intervention methods for different types of learning disabilities. However, high-quality prospective longitudinal research methods are now being applied to the study of treatment methods for reading disabilities, and that research is summarized here.

Research attempting to identify effective treatment methods for different types and severity levels of reading deficits has been

enormously difficult. This is because typical treatment studies have not been able to reliably determine whether the outcomes seen were attributable to the treatment method, the child's general development, the child's previous instruction, the concurrent instruction being provided in the regular classroom, or combinations of these factors. In addition, a majority of treatment studies have been hampered by not having control over teacher expertise and training. Thus, if a treatment method does or does not work effectively, one does not know if it is because of the characteristics of the method, the

characteristics of the teacher, or the characteristics of the child.

Since the late 1980s, a number of well-designed longitudinal treatment studies have been conducted. Because these studies have the capability to intervene with children early on and follow them over time, many of the methodological problems described above have been addressed. These intervention studies have provided information about how to prevent reading disabilities as well as how to address reading disabilities once they are detected at later ages.

For example, Blachman and her colleagues⁵⁹⁻⁶¹ have shown that instruction in phonological awareness at the kindergarten level has significant positive effects on reading development during the first grade. Within this context, research has demonstrated that proper instruction carried out by informed teachers can prevent reading failure both for children with inherent LD in basic reading skills and for children whose lack of exposure to “language rich” environments and language development activities during the first five

years of life places them at risk for reading deficits. For instance, in a series of studies, Blachman^{60,61} provided 84 low-income, inner-city children with 11 weeks of intensive instruction, 20 minutes per day, with one teacher instructing a small group of four to five students in several aspects of phonological awareness. Prior to instruction, classroom teachers also received 14 hours of intensive training. At the end of the 11 weeks, children receiving the interventions significantly ($p < 0.0001$) outperformed control children at reading phonetically regular words and at related tasks. A follow-up study conducted in February and May of the first-grade year showed that the gains were maintained if the first-grade curriculum continued the same emphasis on phonological skill development. Similar studies of kindergarten and first-grade chil-

dren conducted by other researchers⁶²⁻⁶⁴ have yielded similar results.

Unfortunately, not all children with reading disabilities have the benefit of appropriate early interventions. As discussed earlier, most children whose reading disability is not recognized until third grade or later and who receive standard interventions fail to show noticeable improvement. However, intensive instruction of appropriate duration provided by trained teachers can remediate the deficient reading skills of many children. For example, in one study, Alexander and her colleagues⁶⁵ provided 65 severely dyslexic children with 65 hours of individual instruction in addition to group instruction in phonemic awareness and synthetic and analytic skills. This intensive treatment approach improved the reading skills of the children from an initial reading score of 77 to an average of 98.4 (mean = 100) on a measure of alphabetic reading skills. Longitudinal studies continue to demonstrate the efficacy of intensive and informed multidimensional treatment programs.^{64,66}

Several additional findings have emerged from these longitudinal treatment studies. It is clear that children with severe phonological deficits, leading to poor decoding and word recognition skills, respond to treatment at slower rates than youngsters with mild to moderate deficits.^{44,67} In addition, instruction and interventions for reading failure, which focus primarily on context and reading comprehension without commensurate attention paid to phonological awareness, decoding, and word recognition, show limited results.⁶⁷⁻⁶⁹ Finally, the success of even the best-designed reading intervention program is highly dependent upon the training and skills of the teacher.^{22,29-31,38}

Disability in basic reading skills has been a prime candidate for treatment studies because it is the most common form of LD, it is the most objectively identifiable, and more knowledge is available concerning its causes and developmental course. Interventions for other types of learning disabilities have been developed but not studied as extensively and not studied in prospective, longitudinal research. There is as yet no solid indication whether early, effective interventions for disability in basic reading

Instruction in phonological awareness at the kindergarten level has significant positive effects on reading development during the first grade.

years of life places them at risk for reading deficits. For instance, in a series of studies, Blachman^{60,61} provided 84 low-income, inner-city children with 11 weeks of intensive instruction, 20 minutes per day, with one teacher instructing a small group of four to five students in several aspects of phonological awareness. Prior to instruction, classroom teachers also received 14 hours of intensive training. At the end of the 11 weeks, children receiving the interventions significantly ($p < 0.0001$) outperformed control children at reading phonetically regular words and at related tasks. A follow-up study conducted in February and May of the first-grade year showed that the gains were maintained if the first-grade curriculum continued the same emphasis on phonological skill development. Similar studies of kindergarten and first-grade chil-

skills will affect the developmental course of other forms of learning disability.

Outcomes

Learning disabilities, sometimes inappropriately conceptualized as a “mild” disorder, may be anything but—they may be persistent and may not respond to general instruction or to inappropriate (for example, whole language) instruction. Unless identified early on and taught by expert teachers using detailed and intensive approaches emphasizing teaching both in phonological awareness and phonics instruction, children who learn poorly in the third grade can be expected to learn poorly throughout middle- and high-school grades. Unfortunately, the majority of children with learning disabilities are still not identified until the third or fourth grade and do not receive appropriate and timely reading instruction. In turn, those students with learning disabilities who graduate from high school are destined for few postschool opportunities. The minority of children with LD who received appropriate early intervention have not been identified for long-term follow-up so their long-term outcomes are speculative, but there is reason for optimism in their significantly improved short-term outcomes.

At present, the long-term outcomes for the majority of individuals with learning disabilities who did not receive appropriate early reading instruction are frequently bleak. It is known from the epidemiological data cited earlier that 75% of the children with disabilities in reading who are not identified until the third grade continue to have reading disabilities in the ninth grade.²⁴ In a recent review, Martin⁷⁰ reported that a considerable percentage (26.7%) of high school students identified as having learning disabilities drop out of school prior to graduation. Another 16% of students with learning disabilities exit school for “unknown” reasons without a diploma. Equally disturbing, Fairweather and Shaver⁷¹ found that only 17.1% of the individuals with learning disabilities whom they followed for three to five years after high school were enrolled in any postsecondary course, including vocational courses. Only 6.7% of the students with learning disabilities participated in two-year higher education programs, and only 1.8% participated in four-year programs.

While these data suggest that individuals with learning disabilities do not markedly improve their academic skills (particularly reading skills) and face limited educational and vocational opportunities, it should not be concluded that individuals with LD cannot be taught. They can, but, as stated throughout this paper, interventions are most likely to be successful if applied early and carried out by expert teachers.

Conclusions

The past decade has witnessed a significant improvement in the quality of research on learning disabilities. Much of this recent research has been longitudinal in nature, thus opening the door to the identification

Learning disabilities, sometimes inappropriately conceptualized as a “mild” disorder, may be anything but—they may be persistent and may not respond to general instruction.

of better predictors of different types of LD, their prevalence, their developmental course, and their response to intervention. Specifically,

- The definitional issues addressed in this article continue to be the single greatest impediment to understanding learning disabilities and how to help children and adults with LD.

- Maintaining the term “learning disabilities” makes little sense for scientific purposes, clinical purposes, or school policy purposes. Instead, the field must grapple with the clear need to address each type of learning disability individually to arrive at clear definitional statements and a coherent understanding of etiology, developmental course, identification, prevention, and treatment.

- Reading disability in the form of deficits in phonological awareness is the most prevalent type of learning disability and affects approximately 17% of school-age children to some degree.

- While other factors will, no doubt, be identified as contributing to reading disability, deficits in phonological awareness will most likely be found to be the core deficit.

Research during the past decade has shown that deficits in phonological awareness can be identified in late kindergarten and first grade using inexpensive, straightforward testing protocols, and the presence of these deficits is a strong indicator that reading disability will follow.

■ Although it is now possible to identify children who are at-risk for reading failure, and some of the instructional conditions that must be in place from the beginning of formal schooling are understood, it is still true that the majority of LD children are not identified until the third grade. Therefore, policy initiatives should focus on the dissemination of existing early identification and early intervention programs.

■ Interventions for reading disability must consist of explicit instructional procedures in phonological awareness, sound-symbol relationships, and meaning and reading comprehension, and should be provided by expert teachers in the kindergarten and first-grade years.

■ In general, teachers remain seriously unprepared to address individual differences in many academic skills but particular-

ly in reading. However, teachers cannot be expected to know what they have not been taught, and clearly colleges of education have let students down. Regrettably, being unprepared takes a toll on teachers. Many teachers worry about their failures with hard-to-teach students, become frustrated, lose confidence, and leave the profession, or discontinue attempting to teach children with special needs. This cycle of events calls for honest and aggressive reform in higher education.

■ While early intervention is *necessary*, it should not be assumed to be *sufficient* to address the multiple manifestations of learning disability. Even those students who receive appropriate phonological instruction at a young age may require continuous and intensive support to deal with other co-occurring disorders.

■ When policymakers consider “inclusionary” models of instruction, they must consider carefully whether those models can provide the critical elements of intensity and the appropriate duration of instruction, along with teacher expertise in multiple teaching methods and in accommodating individual learning differences.

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Sources for Table 1 on pages 64–65:

The Yale Research Group

The principal investigator for the Yale Learning Disability Research Center is Dr. Bennett Shaywitz, professor of pediatrics and professor and chief of pediatric neurology, the Yale University School of Medicine, 333 Cedar Street, New Haven, CT 06510. The Yale Group also consists of Drs. Sally Shaywitz, John Gore, Pawel Skudlarski, Robert Fulbright, Todd Constable, Richard Bronen, and Cheryl Lacadie from Yale University; Drs. Alvin Liberman,

Kenneth Pugh, Donald Shankweiler, Carol Fowler, Anne Fowler, and Leonard Katz from the Haskins Laboratories; Drs. Jack Fletcher and Karla Steubing from the University of Texas Medical School; Drs. David Francis and Barbara Foorman from the University of Houston; Dr. Dorothy Aram from Emerson College; Dr. Benita Blachman from Syracuse University; Drs. Keith Stanovich and Linda Siegel from the Ontario Institute for Studies in Education; Dr. Rafael Kloorman from the University of Rochester; and Dr. Irwen Kirsch from the Educational Testing Service.

The Ontario Research Group

Drs. Keith Stanovich and Linda Siegel are professors of psychology and special education at the Ontario Institute for Studies in Education (OISE), Department of Special Education, Toronto, Ontario, Canada M5S 1V6 Canada. They are affiliated with the Yale University Learning Disability Research Center funded by the NICHD, as well as senior level scientists at OISE where funding is obtained primarily through the Canadian Research Council.

The University of Colorado Research Group

The principal investigator for the University of Colorado Learning Disability Research Center is Dr. John DeFries, professor and director of the Institute for Behavioral Genetics, the University of Colorado, Campus Box 447, Boulder, CO 80309-0447. The Colorado research team consists of Drs. Richard Olson, Barbara Wise, David Fulker, and Helen Forsberg from the University of Colorado, Boulder; Dr. Bruce Pennington from the University of Denver; Drs. Shelly Smith and William Kimberling from the Boys Town National Research Hospital in Omaha; Dr. Pauline Filipek from the University of California, Irvine; and Drs. David Kennedy and Albert Galaburda from Harvard University.

The Bowman Gray School of Medicine Research Group

The principal investigator for the Center for Neurobehavioral Studies of Learning Disorders is Dr. Frank Wood, professor of neurology and neuropsychology, Bowman Gray School of Medicine, 300 S. Hawthorne Road, Winston-Salem, NC 27103. Also from the Center are Drs. Rebecca Felton, Cecille Naylor, Mary McFarlane, John Keyes, Mark Espeland, Dale Dagenbach, and John Absher from the Bowman Gray School of Medicine; Dr. Raquel Gur from the University of Pennsylvania; Dr. Connie Juel from the University of Virginia; and Dr. Jan Loney from the State University of New York at Stony Brook.

The Johns Hopkins Research Group

The principal investigator for the Johns Hopkins Learning Disability Research Center is Dr. Martha Denckla, professor of neurology, pediatrics, and psychiatry, Johns Hopkins University School of Medicine, 707 North Broadway, Suite 501, Baltimore, MD 21205. The Hopkins research team consists of Drs. Allan Reiss, Harvey Singer, Linda Schuerholz, Lisa Freund, Michelle Mazzocco, and Mark Reader from the Kennedy-Krieger Research Institute at Johns Hopkins; Drs. Frank Vellutino and Donna Scanlon at the State University of New York at Albany; Dr. Mark Appelbaum from Vanderbilt University; and Dr. Gary Chase from Georgetown University.

The Florida State University Research Group

The principal investigator of the Florida State University Learning Disabilities Intervention Project is Dr. Joseph Torgesen, professor of psychology, Florida State University, Tallahassee, FL 32306-2040. Members of the Florida State Research Group are Drs. Richard Wagner and Carol Rashotte from Florida State University; Drs. Ann Alexander and Kytja Voeller from the University of Florida, and Ms. Patricia Lindamood from Lindamood-Bell Learning Processes.

The University of Houston Research Group

The principal investigator for the University of Houston Learning Disabilities Intervention Project is Dr. Barbara Foorman, professor of educational psychology, University of Houston, 4800 Calhoun, Houston, TX 77204. The Houston group also consists of Drs. David Francis and Dorothy Haskell from the University of Houston; Drs. Jack Fletcher and Karla Steubing from the University of Texas Medical School; and Drs. Bennett and Sally Shaywitz from Yale University.

The University of Miami Research Group

The principal investigator for the University of Miami Learning Disabilities Program Project is Dr. Herbert Lubs, professor of pediatrics and genetics, University of Miami School of Medicine, MCCD, P.O. Box 16820, Miami, FL 33101. The Miami group also consists of Drs. Ranjan Duara, Bonnie Levin, Bonnie Jallad, Marie-Louis Lubs, Mark Rabin, Alex Kushch, and Karen Gross-Glenn, all from the University of Miami.