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CHAPTER 11

A Developmental Approach to Learning Disabilities

VIRGINIA W. BERNINGER

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This chapter provides an overview of the various disciplines that have contributed to the conceptualization, diagnosis, and treatment of learning disabilities, with a focus on the field of developmental psychology and representative contributions of this discipline, including a life-span approach. Developmental changes in expression of learning disabilities are illustrated with cases.

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The contributions of linguistics and psycholinguistics are also emphasized. The unresolved issues related to defining learning disabilities for purposes of practice

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and of research are highlighted. Recent approaches to differential diagnosis of specific learning disabilities are discussed, and research on effective prevention and treatment of learning disabilities is reviewed. The chapter ends with current challenges for the field of learning disabilities with respect to research and practice. The unresolved controversies are related to definition and effective service delivery in schools.

I am not being facetious when I characterize my line of research as studying a phenomenon—dyslexia—that schools do not believe exists and that the experts cannot define. Despite these challenges, progress is being made on the research front across the world, but many obstacles remain in translating this scientific knowledge into educational practice, for which cases in this chapter serve as reminders.

LIFE-SPAN APPROACH

Biologically based learning problems may respond to treatment but persist over development in changing forms of behavioral expression. What is initially a problem in *phonological awareness, phonological working memory, and/or accurate phonological decoding* (e.g., Liberman, Shankweiler, & Liberman, 1989; Snowling, 1980; Stanovich, 1986; Vellutino & Scanlon, 1987; Wagner, Torgesen, & Rashotte, 1994) may resolve or persist but is likely to become a problem in *automatic word recognition and/or reading fluency for text* (Biemiller, 1977–1978; Blachman, 1997; Breznitz, 1987; Kuhn & Stahl, 2003; Levy, Abello, & Lysynchuk, 1997; Perfetti, 1985; Wolf, 2001; Young, Bowers, & Mackinnon, 1996) and *spelling and written expression* (Berninger, Abbott, Tomson, & Raskind, 2001). Despite early intervention, some reading and writing problems persist (Bruck, 1992–1993; McCray, Vaughn, & Neal, 2001; Pennington, Van Orden, Smith, Green, & Haith, 1990; Shaywitz, Shaywitz, Fletcher, & Escobar, 1990; Singleton, 1999) across development.

Case Illustrating Behavioral Expression in Early Childhood

Susan's dyslexia was first evident to her teachers at the end of second grade. A bright girl with superior oral vocabulary and background knowledge, she once told her second-grade teacher that she thought the other children were missing the nuances in the stories they read and

talked about. It was only when the research team asked her to pronounce real words on a list outside story context or pseudowords that can only be decoded based on letter-sound knowledge that the nature of her reading problem was apparent: Her reading was overly dependent on guessing at words in context and on memorizing a few words without understanding how to decode unfamiliar words. These are the hallmark signs of dyslexia early in schooling. Because her school did not recognize these hallmark signs in first grade and provide appropriate instruction, Susan's written language learning came to a standstill in third grade.

Case Illustrating Behavioral Expression in Middle Childhood

Sean had the same problems as Susan in the primary grades but received special education that emphasized phonics and oral reading. He learned to read, but his oral reading was not fluent and his silent reading was slow. In addition, his written work was peppered with misspellings that reflected omissions of sounds, additions of sounds, transposition of sounds, and plausible spellings (but not for the specific word used). He often did not complete written assignments satisfactorily. However, because he could read silently with reasonable comprehension, the school dismissed him from special education services. The school did not understand that the hallmark features of dyslexia during middle childhood are persisting reading rate, spelling, and written expression problems in students who have learned to decode sufficiently well to read silently with adequate comprehension. Without additional explicit instruction in these skills, Sean floundered in the regular program.

Case Illustrating Behavioral Expression in Early Adolescence

Sam, who is in eighth grade, has the hallmark signs of dyslexia in adolescence: impaired executive functions for self-regulation of reading, writing, learning from lectures, and completion of long-term assignments. Many schools provide explicit instruction for dyslexics when they are in the early grades, but not in middle school and high school, when they would benefit from systematic, explicit language arts instruction that prepares them for the reading and writing requirements across the curriculum, study skills, note taking, and

test taking. Sam, like many other adolescents with dyslexia, does not receive any explicit instruction related to his learning disability but does receive pull-out services to help him with his assignments in the regular program. However, the school wants to dismiss him from all pull-out services for special help because he passed the state's high-stakes writing test. Both Sam and his parents wanted him to continue to receive special education because he is barely passing most of his written assignments in the regular program. However, according to his school, his learning disability does not have an adverse impact on his performance in the regular program because he receives Ds and that is satisfactory progress. Moreover, because he asks too many questions and does not always raise his hand when answering questions, the school recommended that he be placed in a program for students with behavioral disabilities. They do not think that Sam's verbal IQ in the very superior range, his history of Attention-Deficit/Hyperactivity Disorder (ADHD), or test results using research-supported measures and diagnostic procedures showing that he has dyslexia and dysgraphia are reasons to reconsider dismissing him from special education. His parents are advised by special education officials that if they do not agree, they should hire a lawyer and go to a court hearing.

Sam's own story about his learning problems at different stages of his schooling is reproduced in Figure 11.1. Readers are encouraged to read this story before reading the rest of this chapter in order to understand what it is like to have dyslexia from the perspective of an affected individual during the school years.

Case Illustrating Behavioral Expression in Young Adult Years

Sharon was the first in her family to complete a college education, which she paid for by working many jobs. She did reasonably well but had an enormous struggle learning foreign languages, which has been well documented by researchers (e.g., Ganschow & Sparks, 2000) as the hallmark feature of dyslexia during the college years. Her university graduation was held up because she could not meet the foreign language requirement. She tried three times, twice with one language and once with another language (and even spent a year living in that country to learn the language). She was told by her department that there was no point in being evaluated by the disabled student services on

campus because disabilities affect physical skills like walking and using one's hands. She had had a history of reading rate and spelling problems, but the public school she attended refused to evaluate her because she was so bright. Our research team evaluated her in her early adult years (3 years after she should have graduated) and documented that she met research-supported criteria for severe dyslexia. Based on the test results, we obtained permission for her to substitute an alternative course for the foreign language requirement. By the time this volume is published, she should have her undergraduate degree.

At the end of this chapter, these cases are discussed again from the perspective of how their literacy development might have been different had appropriate educational programs been in place. Appropriate educational programs include both diagnostic assessment and differentiated instruction.

SIGNIFICANCE OF LEARNING DISABILITIES FOR CHILD PSYCHOLOGY

Five domains of development have proved reliable and valid in understanding and assessing child development: cognitive and memory, aural receptive and oral expressive, gross and fine motor, attention and executive function for self-regulation, and social-emotional (Berninger, 2001). Children with mental retardation (global developmental disability) fall outside the normal range in each of these domains of development. Children with Pervasive Developmental Disorders (including Autism Spectrum Disorder) fall outside the normal range in two or more of these developmental domains. Some children have primary impairment in one developmental domain (e.g., primary language disorder). Children with mental retardation, Pervasive Developmental Disorder, or primary language disorder will have some difficulty with learning academic subjects and are unlikely to achieve at the population mean. However, there are other children who are generally within the normal range in most areas of development, but who have a specific kind of learning problem, a learning disability. If unidentified and untreated, learning disabilities can significantly impair a child's overall cognitive and social developmental functioning.

One in five children has some kind of learning disability. The most frequently occurring developmental

I'm fourteen years old and in the eighth grade. I have dyslexia and dysgraphia. I am going to tell you about what it is like. Up until kindergarten I was fine, I was running around just like everybody else my age. Then in first grade that changed. Every body else was learning to read and write, I could write letters but not put them in to words or read what every body else could. I felt really stupid and every body else called me stupid kid. After a month of not being able to read and write the school put me in a speckle class with four other kids to try to figure out how to read and write.

In sixth grade I continued to be in the group because I still couldn't read or write very well. I felt stupid even though I was better at math and science than every one else. No body else was as bad as I was in every subject. I couldn't figure out why I just couldn't do it. It would take me twenty to thirty minutes to read a single paragraph and I couldn't figure out why. In the same amount of time somebody else could read five pages. Nobody could read what I had ritten not even myself.

That summer I was diagnosed with dyslexia and dysgraphia at the University of Washington. I was able to go to the summer program for dyslexics and it made reading a bit better and easier. Fifth grade was easier because I knew I was smart and my teacher helped me with computers and let me do video reports in stead of a paper.

The next summer I went again to the university. It helped me with spelling. That he helped me with the next year so that language arts was ok when it came to papers. Seventh grade was good I enjoyed all my classes because there was a lot of short stories.

~~Figure 11.1~~

The university therapy made me feel that the dyslexia and dysgraphia was being erased away. In fifth and sixth a teacher worked with me to cover it up and my mother continue to work with me on that. The school in seventh and eighth grade didn't help at all. Currently the school has consild my IEP and my reaction to that was that I didn't want to be stupid again. I'd like to read, write and spell fine but I can't.

Figure 11.1 "My Story," told by eighth-grader with dyslexia, dysgraphia, and ADHD (Inattentive subtype).

Disorder of childhood is specific learning disability in children whose development is otherwise in the normal range. Sometimes a child's problem may be specific to one academic domain (reading, writing, or math). Sometimes a child's learning problem is in aural/oral language, nonverbal reasoning, or social cognition, which affects school functioning even though none of these is a subject in the school curriculum. Sometimes a child has disabilities in more than one domain. The focus of this chapter is on learning disabilities that affect written language. Learning disabilities that are specific to reading and/or writing are among the most frequently occurring learning disabilities in school-age children and youth and have received the most research attention. Dyslexia, which was used to illustrate the

changing developmental expression of a learning disability across schooling, is only one kind of learning disability.

MULTIDISCIPLINARY STREAMS OF KNOWLEDGE ABOUT LEARNING DISABILITIES

Federal special education law in the United States specifies that multiple disciplines should be involved in the assessment and educational planning of students with learning disabilities. Some other countries (e.g., Canada and England) have comparable laws for identifying and educating children with learning disabilities. Multiple

disciplines have also contributed to both research and clinical practice in the field of learning disabilities. These include neurology, experimental cognitive psychology, special education, linguistics, psycholinguistics, speech and child language, clinical and school psychology, and developmental psychology.

Neurology

Neurologists were the first to identify the extreme difficulty some otherwise normal children have in learning to read. One of the most informative introductions to the pioneering contributions of neurologists at the end of the nineteenth and beginning of the twentieth century is "The Historical Roots of Dyslexia" (Shaywitz, 2003, chap. 2). Neurology continued throughout the twentieth century to contribute, primarily through clinical studies (e.g., Orton, 1937). Now in the twenty-first century, this field continues to contribute through the use of *in vivo* brain imaging (scanning the brains of living children and adults as they perform cognitive and language tasks; for review, see Berninger & Richards, 2002).

Experimental Cognitive Psychology

Beginning early in the twentieth century, psychology contributed to the available literature by developing scientifically defensible paradigms for investigating mental processes involved in reading (e.g., Huey, 1908/1968). By the middle of the twentieth century, the psychology of reading had generated a wealth of knowledge about teaching children to read (e.g., Bond & Tinker, 1967; Gates, 1947; Gray, 1956; Harris, 1961), and this knowledge was transmitted in many (but not all) teacher training programs. Many schools had reading specialists who were well trained in reading (often with 60 to 90 graduate credits) and who were available for assessment, consultation, and small group instruction in local buildings. Decisions about who to test and teach and about how to work with teachers was left to specially trained professionals who were allowed to function in a flexible manner without burdensome regulations and paperwork. Unfortunately, not all schools had access to such professionals. Parents often had to turn to services outside the public school if their child had a specific learning disability in reading or writing.

Special Education

By the early 1960s, a national political movement led by parents was gaining momentum. Parents wanted to understand why schools could not teach children who had normal intelligence to read and write. This movement led to a parent-organized, landmark conference in 1963 in Chicago where Samuel Kirk (Kirk & Kirk, 1971) first proposed the label "learning disabilities." Following that conference, parents of children with learning disabilities partnered with parents of children with mental retardation to mount a national effort in the United States that culminated in the 1975 federal legislation, Public Law 94-142, that guarantees a free and appropriate education for all students with educationally handicapping conditions. Because professionals could not agree about how to define what a learning disability is (inclusionary criteria), the federal law defined it on the basis of what it is not (exclusionary criteria: It is not due to mental retardation, sensory acuity or motor impairment, lack of opportunity to learn, or cultural difference).

To support this new field of special education, the U.S. Department of Education provided funding for training programs for special educators, model demonstration projects, and research on teaching special populations of students with educationally handicapping conditions. (See Torgesen, 2004, for the history of the field of special education; see Johnson & Myklebust, 1967, and Kirk & Kirk, 1971, for a description of early conceptualization and practices in special education.) However, because "appropriate" was not defined on the basis of developmental and educational science, this legislation has often resulted in costly legal proceedings and adversarial relationships between parents and schools, without resulting in better academic achievement of students with learning disabilities. In fact, meta-analyses indicate that special education for students with learning disabilities has not been effective (e.g., Bradley, Danielson, & Hallahan, 2002; Steubing et al., 2002), especially in reading (Vaughn, Moody, & Schumm, 1998).

One reason for the relative ineffectiveness of special education is that special education teachers are not given much preservice training in the psychology of teaching reading; they also are not taught instructional practices that cover all reading and writing skills in the general education curriculum in a grade-appropriate manner from K to 12. Currently, many preservice teacher training programs advocate philosophical approaches (e.g.,

constructivism, which advises against explicit instruction) that are not consistent with what research in developmental science and educational science during the past 3 decades has shown is effective in teaching students with specific learning disabilities—namely, explicit instruction to bring language processes into conscious awareness. (See Berninger & Winn, in press; and Mayer, 2004, for shortcomings of constructivism in contemporary educational practices.) There is a myth that explicit instruction is skill and drill, but that is not the case (see Berninger, Nagy, et al., 2003, for examples of explicit instruction for developing linguistic awareness in reflective ways that are intellectually engaging).

Moreover, paraprofessionals, most of whom do not have specialized training in teaching reading or as much professional preparation as general educators, are increasingly providing instruction for students with learning disabilities. Many schools hire reading specialists trained outside professional preparation programs and in primarily a single method. There is unlikely to be a single program that meets the needs of all students. Children with specific reading and writing disabilities are more likely to learn to read and write if taught by professionals who are skilled in differentiated instruction; that is, they can construct programs that address all the necessary reading and writing skills at a specific stage of reading or writing development and individualize, if necessary, for specific students in group learning settings (Berninger, 1998).

In short, there are a number of unresolved problems in identification and service delivery for students with specific learning disabilities. It may not be possible to achieve the desired goals by simply legislating them; these goals probably require educating the educators as well as teaching the affected individuals (Berninger, Dunn, Lin, & Shimada, 2004; Berninger & Richards, 2002).

Developmental Psychology

In contrast to special education, which is an applied discipline, developmental psychology is a scientific discipline that contributes relevant basic knowledge to understanding learning disabilities. These contributions, which are discussed later in the chapter, include understanding rule-learning deficits; multiple levels of language; automaticity, fluency, efficiency, and timing deficits; comorbidities, normal variation, gender differences; nature-nurture interactions; life-span approaches;

prevention and treatment validity; and randomized, controlled longitudinal experiments. Many of these contributions draw on earlier and concurrent contributions from linguistics and psycholinguistics.

Linguistics and Psycholinguistics

Linguistics specifies how speech is represented in English orthography in a rule-governed (not purely arbitrary) way and documents the morphophonemic nature of English (e.g., Venezky, 1970, 1999). Although spelling units (typically one or two letters in length) generally represent speech sounds, called phonemes, in a predictable manner (alternations or a set of rule-governed options such as the /k/ and /s/ sound associated with the letter c), not all spellings are perfectly predictable. Much of the predictability of American spelling relies on the morphology as well as the phonology of the language; for example, signal preserves the spelling of the stem *sign*. It has also been well established that knowledge of alphabetic principle (one- and two-letter spellings that represent the phonemes) can explain the acquisition of one- and two-syllable words of Anglo-Saxon origin that occur with high frequency in reading materials in the lower elementary grades (for reviews, see Balmuth, 1992; Ehri, Nunes, Stahl, & Willows, 2001; Rayner, Foorman, Perfetti, Pesetsky, & Seidenberg, 2001).

However, knowledge of morphology is critical to the acquisition of the *longer, more complex written words* that occur with high frequency in reading materials from mid-elementary school through high school and college (Carlisle, 2004; Carlisle & Stone, 2004; Carlisle, Stone, & Katz, 2001; Nagy, Anderson, Schommer, Scott, & Stallman, 1989; Nagy, Osborn, Winsor, & O'Flahavan, 1994). From fourth grade on, students encounter in their school texts an increasing number of complex words in terms of sound-letter relations and internal structure (i.e., syllabic or morphemic structure; Carlisle, 2000; Carlisle & Fleming, 2003; Nagy & Anderson, 1984). Students who earlier struggled with mastering alphabetic principle because of difficulties in phonological processing (Liberman et al., 1989) face additional challenges in learning to recognize specific words automatically: (a) creating and linking precise phonological and orthographic representations (Ehri, 1992; Perfetti, 1992), and (b) encountering low-frequency written words frequently enough (White,

Power, & White, 1989). Students who were earlier taught phonics and may have learned letter-sound correspondences in alphabetic principle, word family patterns (e.g., -at in pat, bat), and syllable types (e.g., open and closed, vowel teams, silent e, r-controlled, and -le) may need additional strategies to deal with the complexity of English orthography (Schagal, 1992), especially in content area texts, which may have spellings unique to word origin (Anglo-Saxon, Latinate, or Greek), complex word structures, and unfamiliar, low-frequency words.

Another contribution of linguistics was demonstrating that most language knowledge is implicit (unconscious), but learning to read requires explicit instruction that brings this implicit knowledge to conscious awareness (Mattingly, 1972). Programs of explicit instruction in word decoding that draw on alphabetic principle and morphological structure have been developed by Henry (1988, 1989, 1990, 1993, 2003) and Lovett and colleagues (e.g., Lovett et al., 1994, 2000). Both programs require children to manipulate units of phonology, orthography, and morphology (see Figure 11.2). Both programs combine explicit instruction and strategy instruction and practice, which a meta-analysis showed

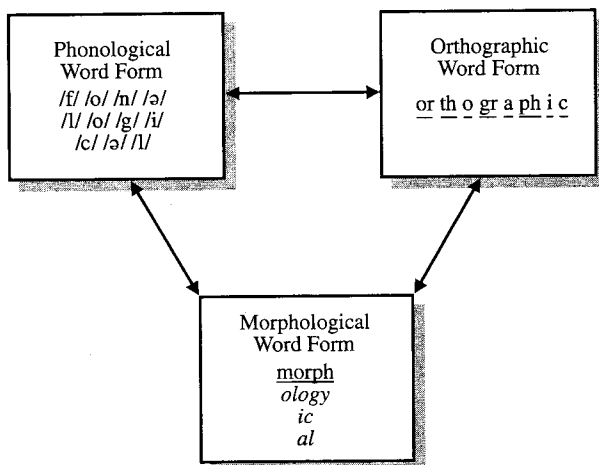


Figure 11.2 Schema of three word forms and their parts that are interrelated in decoding in working memory and creating precise orthographic word forms in long-term memory. Sources: From "Processes Underlying Timing and Fluency of Reading: Efficiency, Automaticity, Coordination, and Morphological Awareness" (Extraordinary Brain Series, pp. 383–414) by V. Berninger, R. Abbott, F. Billingsley, and W. Nagy, 2001, in *Dyslexia, Fluency, and the Brain*, M. Wolf (Ed.), Baltimore: York Press; and *Brain Literacy for Educators and Psychologists*, by V. Berninger and T. Richards, 2002, San Diego: Academic Press.

was the most effective approach for improving reading skill (Swanson, 1999).

Henry's (1990, 2003) program focuses on reading and spelling words from different etymological backgrounds: words of Anglo-Saxon, Romance, and Greek origins. For each word origin, students are taught linguistic units in written words (i.e., letter-sound correspondences, syllable types, morphemes). Before receiving such instruction, third, fourth, and fifth graders had letter-sound knowledge but little knowledge of syllable or morpheme patterns; the third and fifth graders who received the morphophonemic training linked to word origin improved significantly more in reading and spelling than those who received only basic phonics (Henry, 1988, 1989, 1993). Lovett (e.g., Lovett et al., 1994, 2000) validated methods to improve the word-reading skills of students with reading disabilities: PHAB/DI (direct instruction in sound analysis, blending skills, and letter-sound correspondences), WIST (four word identification strategies: using analogy, seeking the part of the word you know, attempting variable vowel pronunciations, and peeling off affixes), and Combined PHAB/DI and WIST (Phonological and Strategy Training Program [PHAST]). Clinical studies showed positive gains in reading both trained and untrained (transfer) words (Lovett, 2000).

However, the concept of how knowledge of morphological structure in low-frequency words can help students read content area texts from the fourth grade on is less widely understood. Analysis of the number of distinct words in printed school English showed that students encountered more than 88,000 "distinct" words in texts through ninth grade (Nagy & Anderson, 1984). About half the words in printed texts through ninth grade occur once in a billion words of text or less (e.g., *inflate*, *extinguish*, *nettle*), so knowledge of word-formation processes becomes necessary (Nagy & Anderson, 1984). For every word a student learns, there are between one and three related words that should be understandable to the student because of semantic transparency of words—whether the meaning of the base word is apparent in a longer word that contains that base word (e.g., *red* and *redness* have relative semantic transparency, whereas *apply* and *appliance* do not)—that reduces the number of distinct words that need to be learned (Nagy & Anderson, 1984). About 60% of the unfamiliar words encountered by students in the middle school years and beyond are sufficiently semantically transparent that a reader might be able to infer the mean-

ing of the word from context (Nagy et al., 1989). Thus, students with reading and writing disability also need explicit instruction in the word formation processes and inferring word meaning from context.

Triple Word Form Theory

Studies that integrated treatment and brain imaging provided support for the theory depicted in Figure 11.2. Both unique neural signatures for the three word forms (Richards et al., 2005, 2006) and cross-over effects (Richards, Aylward, Raskind, et al., in press) were observed: Individuals who received *morphological treatment* showed significant changes in *phoneme mapping* during brain scans, whereas individuals who received *phonological treatment* showed significant changes in *morpheme mapping* during brain scans. Richards et al. (2002) showed that morphological awareness training improved efficiency (rate) of phonological decoding and led to greater metabolic efficiency in neural processing during phonological judgment while the brain was scanned than did training in only phonological awareness. In addition, structural equation modeling of subphenotypes in the family genetics study showed that a second-order factor modeled on indicators of each word form factor predicts reading and spelling outcomes better than the first-order factors for each word form (Berninger, Abbott, Thomson, Wijsman, & Raskind, in press). The benefits of Wolf et al.'s (2003) RAVO, an intervention that trains rapid automatic retrieval of spoken names (phonology), vocabulary, and orthography, for the reading disabled may be related to the way it integrates phonological, orthographic, and morphological word forms.

Speech and Language Pathology and Child Language

Linguistics is a basic discipline. A professional specialization for applying basic knowledge of child language is speech and language pathology. All public schools at the beginning of the twenty-first century, in large part because of the federal special education laws, now have access to practitioners with professional training in speech and language pathology. Although they primarily work with children who qualify for services under the category of Communication Disorders, many of whom have more severe problems in receptive aural language, speech, or expressive oral language than those with specific learning disabilities, they are typically the professionals in the schools with the most training in language.

Thus, they are a valuable resource for other educational professionals because children with reading and writing disabilities often have associated aural/oral language processing deficits. Developmental studies by speech and language specialists have shown that speech and language problems during the preschool years are associated with a variety of developmental outcomes during the school-age years, including (a) mental retardation, (b) specific aural/oral language impairment, (c) specific reading disabilities, (d) specific writing disabilities, and (e) normal reading function (e.g., Aram, Ekelman, & Nation, 1984; Bishop & Adams, 1990; Catts, Fey, Zhang, & Tomblin, 1999, 2001).

Clinical Psychology and School Psychology

Clinical psychology and school psychology are applied disciplines that have contributed scientific research knowledge about learning disabilities and train the practitioners who serve individuals with specific learning disabilities in the private and public school sectors. They are typically trained in cognitive, academic, social, and emotional assessment that yields relevant information for diagnosing and treating specific learning disabilities. Historically, they have relied on education to translate the assessment results into instructional practice. However, recently, there is growing interest in the treatment validity of linking psychological assessment with research-supported instructional practices (see Berninger, Dunn, & Alper, 2004). Because the federal special education law stipulates that all students with educationally handicapping conditions have the right to evaluation, whether or not they attend public schools, psychologists who work in school settings assess students attending public schools, students referred from private schools, and students who are home-schooled. However, there is a large and growing market for clinical psychologists, especially those with neuropsychological training, because many parents seek independent evaluations outside the public school. This trend is likely to increase because student achievement standards continue to increase in this era of educational accountability and are linked to high school graduation in some states.

Developmental Pediatrics

The child's pediatrician or family physician is the professional who often has the best knowledge of an individual child across development. Levine, who has been a

