1 The Reading Brain, Literacy Instruction, and RTI

Strategies Presented in This Chapter Include

- ✓ Big Ideas From Reading Research
- ✓ Several Informal Early Literacy Assessments
- ✓ A Phonics Literacy Checklist
- ✓ DIBELS
- ✓ Ten Tactics for the Brain Compatible Classroom
- ✓ Brain Compatible Research Results for the Classroom Teacher
- ✓ The Basics of RTI in Reading

THE GOOD NEWS IN READING RESEARCH!

Although the initial picture of reading success among students with learning disabilities and other reading difficulties, as presented by the National Reading Panel (NRP), was not overly positive, there is much good news to report (King & Gurian, 2006; National Institute of Child Health and Development [NICHD], 2000; Sousa, 2005). Research on reading instruction has exploded in the past two decades, resulting in major advances in several related areas including the brain and central nervous systems bases for reading, literacy instruction, phonological awareness research, and reading comprehension instructional

tactics for students with reading difficulties (Bender, 2008; Bhat, Griffin, & Sindelar, 2003; Chard & Dickson, 1999; Joseph, Noble, & Eden, 2001; Kemp & Eaton, 2007; Rourke, 2005; Sousa, 2005; Sylwester, 2001; Wood & Grigorenko, 2001). Much of this research (e.g., brain functioning during reading) is rather esoteric in nature and generally not readily accessible for the practicing teacher. In fact, a major emphasis of this book is to make this research—and the instructional ideas that are based on it—readily available to every elementary teacher in the classroom.

There is more good news. Because of the passage of the Individuals With Disabilities Education Act (IDEA) of 2004, teachers across the nation now are beginning to implement response to intervention (RTI) procedures that more closely track how struggling students are doing in their reading and early literacy (Bender & Shores, 2007; Bradley, Danielson, & Doolittle, 2007; Fuchs & Fuchs, 2007; Kemp & Eaton, 2007). As teachers "ramp up" their efforts in this regard, reading instruction will improve for many struggling readers as earlier interventions are provided that are specifically targeted to address their reading problems.

Within this growing body of research, three emerging emphases will provide the basis for this text—the emphasis on a holistic view of early literacy instruction (Haager, 2002; McCutchen et al., 2002; Shaker, 2001), the growing literature on brain compatible reading instruction in the classroom (King & Gurian, 2006; Prigge, 2002; Rourke, 2005; Sousa, 2001, 2005; Sylwester, 2001), and the recent RTI mandate (Bradley, Danielson, & Doolittle, 2007; Fuchs & Fuchs, 2007). Each of these emphases is presented below to provide a backdrop for the strategies discussed in this and each subsequent chapter.

BIG IDEAS FROM EARLY LITERACY RESEARCH

As mentioned previously, there has been an explosion of research in the area of reading within the past decade (Bender, 2008; King & Gurian, 2006; Rourke, 2005; Sousa, 2005). As a result, a number of recent research-based conclusions have been developed concerning how reading skills progress among learners without reading difficulties. A number of points about reading instruction from a variety of sources are presented to provide a basis for discussion of the reading strategies and tactics for students with reading problems (Fuchs & Fuchs, 2007; Kame'enui, Carnine, Dixon, Simmons, & Coyne, 2002; NICHD, 2000; Sousa, 2005). These big ideas represent our best understandings of reading difficulties, as well as the best practices in reading instruction for all students today. These seven ideas are

- Reading is not natural.
- There is no "reading" area in the brain.
- Reading disabilities result from both genetic and environmental influences.
- Development of reading skill is complex and long term.
- Students must learn the alphabetic principle and the alphabetic code.
- Phoneme manipulation and phonics are the most effective ways to teach reading.
- Students must develop automaticity with the code.

Reading Is Not Natural

Unlike sight, hearing, cognition, or the development of language, reading is not a natural process. For example, an infant isolated on an island will develop sight, hearing, attention skills, rudimentary numeration and counting skills, and language of some sort, but reading will not develop naturally (Sousa, 2001, 2005). Of course, a human infant isolated on an island probably would not survive, but give us some literary flexibility here! In short, reading skills will not develop unless these skills are specifically taught, so teachers should emphasize them in every aspect of the school curriculum throughout the earliest instruction in kindergarten, as well as the early and middle school years.

There Is No "Reading" Area in the Brain

Although regions of the brain can be associated with sight, hearing, physical movement, or language, there is no single reading area within the brain. Rather, reading involves many more areas of the brain than does language development but must be understood as a function of linguistic capability (Armstrong, 2007). While speech and language seem to be "hardwired in the brain," with specific areas related to these skills, reading is not hardwired in only one or two brain areas (Sousa, 2001). This is one reason that reading skill does not develop naturally.

Reading Disabilities Result From Both Genetic and Environmental Influences

The evidence for a genetic abnormality that may lead to a reading disability has grown stronger over the years (Wood & Grigorenko, 2001), and various research studies have implicated a variety of specific regions within specific chromosomes—particularly chromosomes 1, 2, 6, 13, 14, and 15—as possible genetic problem areas for students with learning disabilities (Raskind, 2001). However, much more research is needed prior to isolating a specific genetic basis for either learning disabilities or reading disabilities. Further, although teachers cannot control genetic influences in a child's life, they can control the environment in which reading instruction occurs, and manipulating that reading environment offers teachers the best option to assist students in developing reading skills. For our purposes, we will concentrate on environmental strategies such as RTI, phonemic instruction, and tactics for enhancing reading comprehension, rather than the growing literature on genetic causes of reading problems for students with learning disabilities. Teachers also would be well-advised to adopt such an emphasis on environmental-instructional bases of reading development.

Development of Reading Skill Is Complex and Long Term

All children speak (or communicate in some fashion) before they read, and speech sounds serve as the basis for reading (Sousa, 2005). A *phoneme* is the briefest discrete sound that can communicate meaning. In total, all the languages in the world include only about 150 phonemes (Sousa, 2005). For the

English language, some researchers report 41 phonemes (NICHD, 2000), whereas others suggest there are 44 discrete phonemes (Sousa, 2001). Reading involves making brain connections between phonemes and *graphemes*, or the squiggly lines on a page that represent printed letters. This transition is very difficult for some 30% of children, and these children develop reading problems to some degree; this group also includes children who are later identified as students with learning disabilities.

Just to confuse matters further, there is no one-to-one relationship between the phonemes and the specific letters in our alphabet. Thus, learning to read is both a complex and a long-term endeavor for all students, and students with learning disabilities in particular (Kame'enui et al., 2002). Teachers in kindergarten through middle school should build reading instruction into every instructional period as a primary and major emphasis, and recent federal and state initiatives are emphasizing that instructional need.

We now know that reading is based on the brain's ability to detect and manipulate phonemes, and that students who have not mastered these prereading skills will have great difficulty in reading (Sousa, 2005). Further, phonemic-based skill is a prerequisite for teaching phonics (which is the pairing phonemic skill and letter recognition), and even as late as middle school, phonemic instruction can be an effective component of reading instruction (Bhat, Griffin, & Sindelar, 2003).

Students Must Learn the Alphabetic Principle and the Alphabetic Code

The *alphabetic principle* involves the fact that most phonemes, and all speech sounds in English, can be represented by letters, and the pairing of speech sounds to printed letters is referred to as phonics instruction. Further, a child's ability to decode unknown words is based on those letter-sound relationships. The *alphabetic code* thus represents the relationships between letters and the sounds they represent. Research has documented that students with learning disabilities must learn the alphabetic principle to read effectively across the grade levels; merely memorizing words and word meanings is not enough for successful reading long term (Kame'enui et al., 2002; Sousa, 2005). Further, the alphabetic principle is not learned merely from exposure to print, but must be specifically taught (Sousa, 2005).

Phoneme Manipulation and Phonics Are the Most Effective Ways to Teach Reading

Although debate has raged for decades over phonics versus sight word instructional techniques, the evidence has clearly shown that an emphasis on phonemic instruction, and phonics (as represented by the alphabetic principle involving discrete sound manipulations and sound-letter relationships), is the most effective instructional method for reading for almost all children with and without reading problems (NICHD, 2000). Elementary and middle school teachers should emphasize the relationships between sounds and letters in every subject area whenever possible.

Students Must Develop Automaticity With the Code

While phoneme manipulation, phonetic decoding, word segmentation, and use of context clues to determine word meaning are all essential skills in early reading, rigorous application of these skills for every letter or word on the page would result in a highly cumbersome reading process. Rather, to develop effective reading skills, students must learn the alphabetic principle and the alphabetic code extremely well, so that the brain processing involved in decoding these letter sounds is "automatic" (Kame'enui et al., 2002)—this is referred to as *automaticity*. In that fashion, the student's brain may process many letters, sounds, or words at one time, and fluent reading is possible. Teachers should build their instruction such that every child with reading problems can attain automaticity in reading. Various reading programs described in subsequent chapters (e.g., Academy of Reading by AutoSkill, or Fast ForWord) focus directly on developing automaticity and fluency in all aspects of reading skill, from phonemic awareness and manipulation up through reading comprehension.

REFLECTIVE EXERCISE 1.1
USING THE BIG IDEAS FROM READING RESEARCH

Pause for a moment and consider the big ideas presented above. Almost all these ideas can suggest instructional activities within the classroom for students with learning disabilities and other reading difficulties, and we encourage you to reflect on how many of these ideas are currently implemented in your class. Remember that, with the growing national emphasis on reading, all teachers in elementary and middle grades should be teaching reading skills and should be building an emphasis on these skills into every lesson plan.

THE EMERGING EMPHASIS ON LITERACY

Within the last decade, an emphasis on early literacy instruction—versus merely an emphasis on reading—has emerged (Armstrong, 2007; McCutchen et al., 2002; Shaker, 2001). Literacy approaches focus not only on the discrete skills in reading such as phonics and reading comprehension (Bos, Mather, Silver-Pacuilla, & Narr, 2000; Patzer & Pettegrew, 1996; Smith, Baker, & Oudeans, 2001), but also on the more holistic set of skills that enhances and supports a student's skill in reading, such as the student's ability to speak, write, and listen effectively, as well as to use these literacy skills in reading and communicating (Winn & Otis-Wilborn, 1999). The emphasis in a literacy approach is on the interrelationship between reading, writing, and language and the interdependence of these systems within the human brain. However, this certainly does not mean that the particulars of phoneme manipulation, phonics, word attack, or comprehension are not taught—they are. Rather, the emphasis is on the end goal of reading—the ability to derive meaning from the written word and to use that skill as a communication tool.

Further, within the literacy emphasis, there is a growing emphasis on assisting struggling readers to improve their literacy skills, rather than merely a focus on remediation of specific and discrete reading deficits (Dayton-Sakari, 1997). In most cases, this results in an emphasis on the phoneme manipulation skills that have not been mastered previously or on instruction on the alphabetic principle. Smith et al. (2001) delineated several components of early literacy instruction that constitute an effective literacy program. Notice the emphasis on discrete skill instruction on letter names and sounds in the following skills.

1. Allocation of time for daily, highly focused literacy instruction
2. Consistent routines for teaching the big ideas of literacy
3. Explicit instruction for new letter names and sounds
4. Daily scaffolded or assisted practice with auditory phoneme detection, segmenting, and blending
5. Immediate corrective feedback
6. Daily application of new knowledge at the phoneme and lettersound levels across multiple and varied literacy contexts
7. Daily reviews

A word of explanation may be in order for several of these skills. First, examples of big ideas in literacy instruction may include things such as teaching the alphabet as code or teaching students that all stories have structure (e.g., character, story problem, climax) and using story structure as a basis for instruction. Next, the term *scaffolded* in Point 4 refers to the supports that a teacher provides to an individual child in assisting that child to improve his or her current reading skill. Typically, scaffolded instruction involves an in-depth, individualized examination of the reading skills, instructional support from the teacher to the child for the next skill to be mastered, and a planned withdrawal of support from the student to ensure that the student masters each successive skill independently (Larkin, 2001).

Research on Literacy Instruction

Consistent with the broader research results reported earlier, research on early literacy instruction has supported a strong phoneme-based instructional approach for students with reading problems (Bender, 2008; Bos et al., 2000; NICHD, 2000; Patzer & Pettegrew, 1996; Smith et al., 2001). The research supports the use of group-based oral reading, or choral reading, as an instructional technique to enhance reading fluency, because reading is dependent upon a student's language ability. Also, choral reading practice is recommended because students often are called upon to read orally in class across the grade levels (NICHD, 2000). This emphasis will be discussed in more detail later in the book.

Next, early instruction in reading should be quite robust; that is, instruction in each area of reading skill should be undertaken with sufficient intensity

to assist students in reaching their early reading goals. Research has also shown that, for young readers who lag behind others in kindergarten and first grade, phonological instruction is even more important in their early literacy instruction (AutoSkill, 2004; Kame'enui et al., 2002). In fact, students who miss early phonological instruction always will lag behind in reading, and phonological instruction may be necessary in the late elementary or middle school grades for those students with reading problems.

McCutchen et al. (2002) used an experimental design and studied teachers' awareness of these newly emerging literacy emphases by investigating teachers' instruction and student outcomes in 44 classrooms scattered throughout the western states. These researchers not only assessed teacher knowledge of these literacy skills, but also observed how teachers instructed their students and noted the students' outcomes in phonological awareness, listening comprehension, and word reading. The results indicated that teachers were, in many cases, unaware of this emerging emphasis on phonemic instruction. However, based on a two-week instructional workshop, the teachers in the experimental group quickly grasped the importance of this emphasis, as well as the instructional techniques involved. Those teachers then implemented these practices, and students' reading skills improved rather dramatically in each area.

The good news from this study, as well as other research, is that phonological awareness is a teachable skill—teachers can learn these instructional techniques and students can learn the phonological manipulation skills that will improve their overall reading skill. Many of these instructional techniques are presented in Chapter 2, which concentrates on phonemic instruction, as well as subsequent chapters. Further, these results document that adequate instruction in that area will enhance the reading of students who display subsequent reading disabilities (Kame'enui et al., 2002; Smith et al., 2001). Thus, as teachers become aware of this broader emphasis on early literacy instruction, as well as the need to emphasize the alphabetic principle and phonemic instruction, the prognosis for remediation improves considerably across the grade levels (Bhat, Griffin, & Sindelar, 2003).

Further, phonemic instruction can be managed very effectively in a technology format (AutoSkill, 2004). Various computer-based reading programs have been developed that emphasize a student's ability to detect, compare, and manipulate phonemes, and this will save teachers considerable instructional time.

REFLECTIVE EXERCISE 1.2
DEVELOPING LITERACY INSTRUCTIONAL SYSTEMS

With the emerging emphasis on literacy in recent years, coupled with the No Child Left Behind legislation from the federal government in 2001, a number of comprehensive literacy programs have been developed. These new literacy programs involve a wide array of skills ranging from early phoneme instruction to reading and writing skills. As one example, you may wish to review the Four Blocks program by Patricia M. Cunningham and Dorothy P. Hall (www.four-blocks.com). The four blocks involve (1) guided reading, (2) self-selected reading,

(3) writing, and (4) working with words. The early research on this project indicated strong initial results in one school in North Carolina. The Four Blocks program is a comprehensive program that involves the entire range of literacy skills.

Word Play and the Development of Early Literacy Skills

With the continuing research efforts in reading, as well as the advent of several newly developed research technologies (described below), we have gained a more complete picture not only of how reading skills develop, but of the dependent relationship between reading and the development of language. A representation of the development of these interrelated skills is presented below.

A List of Early Literacy Skills	
Development of oral language	Birth to 24 months
Phoneme discrimination	Birth to 11 months
Says first words	6 months to 11 months
Follows simple verbal directions	12 months to 17 months
Pronounces first vowels and most consonants	18 months to 24 months
Enjoys having a story read	18 months to 24 months
Awareness of certain letters (such as letters presented in advertising; i.e., *M* stands for McDonald's and *K* for Kellogg's)	24 months to 36 months
Complex phoneme manipulation	48 months to 8 years
Can tell a story	36 to 48 months
Becomes aware of the alphabetic code (i.e., letters stand for specific sounds)	48 months to Grade 1
Begins to read first words	48 months to Grade 1
Can grasp meaning from reading short paragraphs	Grade 1 to Grade 3
Begins to comprehend longer texts	Grade 1 to Grade 3

As you can see, reading is dependent upon the development of language in most children, and children with learning difficulties are no different in terms of these general milestones. However, children at risk for reading failure do progress through these milestones somewhat later than other children. Likewise, children who are hearing impaired do not follow this sequence, but the placement of oral language at the top of this list of skills correctly presents language as a fundamental basis for reading for almost every child.

Also, note that informal reading instruction begins prior to school. In our society, children—including children with learning difficulties in reading—learn that a *K* means breakfast cereal (can't every three-year old grab the cereal from the cabinet under the sink?) and an *M* means McDonald's. Children are

surrounded by letters and many pick up the correct meaning of those letters at an early age. Of course, parents are well-advised to engage in word play or letter play whenever young children show an interest in these letters. This can prepare a child for later work in reading. Finally, teachers should make letter play and word play a fun aspect of the classroom from the prekindergarten programs through the elementary grades. This will greatly enhance the reading skills of the students with learning disabilities in the class and will develop reading skills that will stay with those children throughout life.

ASSESSMENTS OF EARLY LITERACY

Using Informal Literacy Checklists

As an example of a comprehensive literacy strategy, teachers may wish to consider using a literacy checklist. Literacy checklists are available from many sources and have been offered by a number of authors in the literature. The skills on the checklists may reflect the entire array of reading skills ranging from early phonemic awareness to higher-order reading comprehension. However, rather than depend on checklists devised by a reading scholar, Winn and Otis-Wilborn (1999) suggest the use of individually developed checklists for monitoring the literacy of individual students. An individually developed checklist allows the teacher to develop individually the items on the checklist and thus to specifically tailor the checklist to the needs and strengths of the student. A sample of such a literacy checklist is presented in Teaching Tip 1.1.

As you can see, this informal literacy checklist encompasses a wider variety of literacy skills, in this case phonemic and phonics skills, than would a traditional reading instructional lesson, and this broader view is the perspective supported by proponents of literacy instruction. Of course, teachers should vary the reading skills on the checklist for each student to reflect specifically those literacy skills that are relevant for that particular student. For some students, the indicators on the checklist would be exclusively comprehension, and for other students a mix of decoding or word attack skills and comprehension skills may be noted. A checklist for comprehension skills that would be useful for elementary and middle school students is presented in Teaching Tip 1.2. Teachers should feel free to alter or adapt these checklists to exclude or include any skills relevant for a particular student.

DIBELS: An Informal Assessment of Basic Literacy

The *Dynamic Indicators of Basic Early Literacy Skills* (DIBELS; Good & Kaminski, 2002) is an informal assessment of early literacy skills that can be obtained from Sopris West (in Longmont, CO). Although we do not intend to discuss large numbers of curricula or assessments in this book, we will present commercial materials that are research based and can enhance reading assessment and instruction for students with learning difficulties. On that basis, we recommend that every teacher of kindergarten through Grade 3 take the time to investigate this informal assessment of early literacy skills.

TEACHING TIP 1.1

A Sample Literacy Checklist

Name _____ Date _____ Reading Material _____

While listening to a child read, the teacher should note below specific examples of the successes and difficulties experienced. Completing this checklist during several reading activities will present a more complete picture of the child's reading skills. The teacher may also complete this checklist at the end of the grading period, as a postinstructional assessment.

1. Attempts to decode unknown words _____
   _____
   _____
   _____

2. Difficulty with initial consonant sounds _____
   _____
   _____
   _____

3. Difficulty with vowels _____
   _____
   _____
   _____

4. Difficulty with consonant blends _____
   _____
   _____
   _____

5. Difficulty with multisyllabic words _____
   _____
   _____
   _____

6. Demonstrates self-correcting _____
   _____
   _____
   _____

7. Demonstrates understanding _____
   _____
   _____
   _____

TEACHING TIP 1.2

A Comprehension Checklist for Elementary Textbook Reading

Name _____ Date _____ Reading Material _____

While listening to a child read from a subject area textbook, the teacher should note below specific examples of the successes and difficulties experienced. Completing this checklist during several reading activities will present a more complete picture of the child's reading skills. The teacher also may complete this checklist at the end of the grading period, as a postinstructional assessment.

1. Reflects on the relationship between the current chapter and previous or subsequent chapters _____
   _____
   _____
2. Reviews chapter headings and subheadings prior to reading _____
   _____
   _____
   _____
3. Reviews vocabulary lists or review questions prior to reading _____
   _____
   _____
   _____
4. Reflects on pictures and picture captions presented in text _____
   _____
   _____
   _____
5. Makes predictions about information which may be found in various sections of the chapter text _____
   _____
   _____
6. Reads the chapter reflectively _____
   _____
   _____
   _____
7. Answers comprehension or review questions after reading with 85% accuracy
   _____
   _____
   _____

DIBELS is a research-based assessment that teachers love because it is quite easy to administer. Individual sections of this assessment take approximately two to three minutes to complete, which makes this assessment a user-friendly approach to early literacy instruction (Langdon, 2004).

DIBELS is based on a number of early indicators of literacy success (Haager, 2002). Its four stepping-stones indicate with a high degree of accuracy which students will display learning difficulties and eventual learning disabilities in reading. For example, by two months into kindergarten, students should master onset recognition—referred to as initial sounds fluency—and that measure becomes a benchmark. Students who do not master initial sounds fluency by several months into kindergarten are quite likely to develop later reading difficulties (Langdon, 2004). Other stepping-stones through the first several years of school, such as those presented below, represent similar benchmarks.

Onset fluency (initial sounds)	Two months into kindergarten
Phoneme segmentation fluency	End of kindergarten
Nonsense words fluency	Middle of Grade 1
Oral reading fluency	End of Grade 1

The DIBELS assess students' performance on these benchmarks and can predict, with a high degree of accuracy, which students will develop subsequent reading problems. This assessment also includes some higher-level reading skills such as oral reading fluency through Grade 3. Other DIBELS measures include word-use fluency and retelling fluency (story retelling frequently is used as an indicator of early reading comprehension). Again, for students who meet these benchmarks on time, reading difficulties are not likely to develop. However, for students who do not master these skills by the times mentioned above, reading problems are quite likely to develop. Thus, for teachers to determine which students are having difficulty or may be likely to have difficulty, DIBELS is quite useful as an information measure of early literacy skill. Further, with the emerging emphasis on RTI across the nation, many states (e.g., Ohio and West Virginia) have chosen to use this instrument as the early screening instrument for all students in kindergarten through Grade 3.

BRAIN COMPATIBLE READING INSTRUCTION

With the growing national emphasis on early literacy in mind, we can turn to the emerging information on how the human brain learns to process information during the reading process. This area of research—commonly known as brain compatible instruction—has emerged only within the past 15 years and is based primarily on improvements in the medical sciences (Bhat, Griffin, & Sindelar, 2003; King & Gurian, 2006; Leonard, 2001; Prigge, 2002; Sousa, 2001, 2005; Sylwester, 2001).

Specifically, several brain measurement techniques have emerged that have added to our understanding of brain functioning. First, much of our increasing

understanding of the human brain has come from the development of functional magnetic resonance imaging (fMRI). This is a nonradiological technique—and thus a relatively safe brain-scanning technique—that has allowed scientists to study the performance of human brains while the subject concentrates on different types of learning tasks (Richards, 2001; Sousa, 2005).

The fMRI measures the brain's use of oxygen and glucose during the thinking process, and from that information, physicians can determine which brain areas are most active during various types of educational tasks (Richards, 2001; Sousa, 2005). For example, specialists have now identified brain regions that are specifically associated with various learning activities such as language, math, auditory processing, motor learning, listening to music, or verbally responding to questions in a classroom discussion (Leonard, 2001). Further, a body of research on students with learning disabilities or other reading disorders also has emerged (Sousa, 2001).

As one example of this research, researchers working with Shaywitz at Yale University compared brain functioning of 29 dyslexic readers and 32 nondisabled readers (Shaywitz et al., 1996). Dyslexia readers had great difficulty in reading nonsense rhyming words (e.g., "lete" and "jeat"), whereas normal readers had no such difficulty. Further, using fMRI scans while readers were performing these tasks, these researchers showed that brains of the dyslexic readers were underactivated in the brain region that links print to the brain's language areas, compared to normal readers. However, the brains of the dyslexic readers were overactivated in Broca's area—a brain region associated with spoken language. These researchers suggested that readers with dyslexia were "overcompensating" in Broca's areas for the lack of activation in other areas. Thus, a clear functional difference has been shown between normally reading brains and brains that are challenged by reading.

Another recently developed technique for studying the brain is referred to as PEPSI, which stands for proton echo-planar spectroscopic imaging (Posse, Dager, & Richards, 1997). This technique measures activity in various brain regions by assessing lactate changes in various brain regions, related to a mismatch of the delivery of oxygen to those regions. Richards et al. (1999) compared six dyslexic and seven nondyslexic readers and demonstrated not only differences in brain functioning, but also the brain's ability to modify brain functioning as a result of intensive phonemically based reading instruction.

Many researchers have suggested that the research has developed to a point where specific teaching suggestions may be made (Richards et al., 2000; Shaywitz et al., 1996; Sousa, 2005). Based on this growing understanding of how students with learning difficulties learn, teachers across the nation have begun to restructure their classroom practices based on these brain compatible instruction guidelines (Goldstein & Obrzut, 2001; Leonard, 2001; Sousa, 2005). Although various authors make different recommendations, the ten tactics for a brain compatible instruction classroom, presented in Teaching Tip 1.3, represent some of the accumulated thought in this area; these tactics can enhance your reading instructional practices for all students, in particular students with reading difficulties (Gregory & Chapman, 2002; Prigge, 2002; Richards, 2001; Sousa, 2005).

TEACHING TIP 1.3

Ten Tactics for the Brain Compatible Classroom

1. *Provide a safe, comfortable environment.* Research on learning has demonstrated that the brain serves as a filter on several levels. The brain selectively focuses on sounds, sights, and other stimuli that threaten our safety, often to the exclusion of other stimuli. A second priority is information resulting in emotional responses, and only as a last priority does the brain process information for new, nonthreatening learning tasks (Sousa, 2001). Thus, students with reading problems must not be distracted by either a sense of danger in their learning environment or emotional threats in the classroom. Unsafe classes and emotional threats or challenges can prevent learning.

2. *Provide comfortable furniture.* As a part of structuring a comfortable learning environment, many teachers bring house furniture into the classroom and set up reading areas with a sofa and perhaps several comfortable chairs for students with learning difficulties. Lamps also are used in brain compatible classrooms for more home-like lighting, and some research has suggested that lighting closer to the red end of the light spectrum functions like a wake-up call for the brain (Sousa, 2001).

3. *Provide water and fruits.* Research has shown that the brain requires certain fuels—oxygen, glucose, and water—in order to perform at peak efficiency (Sousa, 2001). Water is essential for the movement of neuron signals through the brain. Research has shown that eating a moderate amount of fruit can boost performance and accuracy of word memory (Sousa, 2001). Thus, in brain compatible classrooms teachers offer students water and dried fruits quite frequently.

4. *Require frequent student responses.* Students with learning difficulties will learn much more when work output is regularly expected from them, because students generally are much more engaged in the process of learning when they must produce a product of some type (Bender, 2001). Products may include a range of activities such as pictures to demonstrate comprehension of an 1860s Midwestern farm or development of a one-act play to show Washington crossing the Delaware River in the battle of Trenton, New Jersey, during the Revolutionary War.

5. *Base instruction on bodily movements when possible.* Motor learning takes place in a different area than do higher order thought processes within the brain. Motor learning is based in the cerebellum and motor cortex whereas higher order learning and planning takes place in the frontal lobes of the cerebrum. Thus, motor learning takes place in a more fundamental or *lower* brain area than does learning languages and other *higher* brain functions. Also, the brain considers motor skills more essential to survival, because our evolutionary ancestors often had to run from predators or to hunt for prey. Consequently, motor skills (e.g., swimming, riding a bike), once learned, are remembered much longer than cognitive skills (e.g., foreign language) without a motor basis. This suggests that whenever possible teachers should pair factual memory tasks of higher order with physical movements to assist in memory for students with learning difficulties.

As an example of movement-based learning in an elementary class, the first author developed the following movement-based teaching idea. Students had read a text selection on the functions of a cell wall in protecting the cell. The lesson required an instructional demonstration that

represented a cell wall in the processes of protecting the cell from bacteria while letting in various food enzymes. Initially three students stood together facing inward and locked their elbows tightly to represent the cell wall. The teacher then pointed out, "The cell wall is very strong to protect the cell." Next, the teacher selected a bacteria (i.e., another student) to try to break into the cell, with the cell wall holding that bacteria out. The teacher stated, "Cell walls protect the cell from bacteria." Finally, the teacher had a student representing the friendly enzyme move toward the cell wall to gain entrance. The cell wall let her in without delay! The teacher concluded, "Cell walls let in food and friendly enzymes." Elementary students who participate in this motor learning example will never forget this simple demonstration, because movement was used as the basis for comprehending this reading selection on the functions of a cell wall.

6. *Emphasize visual novelty*. The human brain is specifically attuned to seek out novelty and differences in stimuli (Sousa, 2001). In elementary grade reading instruction teachers should use color enhancements, size, and shape enhancements in developing worksheets or material posted in the classroom. However, in order to make this an effective learning tool, teachers should specifically discuss with the students why certain aspects of the material are colored differently and the importance of those colored items. Students with reading disabilities will benefit greatly from color and other novelties in the reading passages. Teachers should consider coloring every topic sentence in paragraphs for students with reading disabilities.

7. *Use chanting, rhymes, and music to increase novelty in learning.* Because music and rhythms are processed in a different area of the brain from language, pairing facts to be learned to a musical melody or a rhythmic chant can enhance memory for reading comprehension. Most adults, upon reflection, can remember the song that was frequently used to memorize the ABCs—the tune to *Twinkle, Twinkle, Little Star*—and many students used that same song for other memory tasks in the higher grades (e.g., multiplication or division math facts).

8. *Increase your wait time*. Different brains process information at different rates, independent of intelligence. Of course, elementary students have learned that teachers often will call on the first one or two students who raise their hand after the teacher has asked a question in class. On average, teachers will wait only two or three seconds before calling on someone for an answer, and this period of time between the question and when an answer is called for is defined as "wait time" (Sousa, 2001). However, the brain research has demonstrated the importance of waiting for a few seconds (perhaps seven to ten seconds) after asking a question, prior to calling on someone for the answer. This increased wait time gives students with reading disabilities, many of whom process information more slowly and deliberately, a longer period of time to consider their answer and hopefully raise their hand to volunteer a response to the teacher's question.

9. *Increase students' choices*. Sylwester (2001) emphasized the use of choices for students. In short, if teachers want their students to make reasonable and informed choices when they are not in the context of the school, teachers must offer choices and coach students in making informed choices within the context of the classroom. Such choices may involve options for demonstrating competence or understanding of a set of facts or other choices among assignments on a particular topic.

(Continued)

TEACHING TIP 1.3 (Continued)

10. Use students to teach other students. Teachers should present some information and then pause and let students discuss it and synthesize it (Sousa, 2001). Alternatively, teachers may wish to have students read a short text selection and then discuss it with a peer buddy. One good idea is to have students discuss the information after every five minutes of reading or discussion.

Teachers may say something like the following:

Turn to your learning buddy beside you and take turns explaining the four points I just made and that we just read about. Let me know if you uncover any disagreements in what each of you heard.

The teacher should then move around the room for one to two minutes, listening to the discussions between the students and checking that the students have a correct understanding of the information just presented.

REFLECTIVE EXERCISE 1.3
MY BRAIN COMPATIBLE TEACHING

Consider the ten tactics for brain compatible instruction described in Teaching Tip 1.3 in terms of your current teaching. The research on brain compatible instruction, while emphasizing many of these tactics, was not the origin for many of these ideas, and you may be currently using many of these tactics in either small group instruction or whole class instruction for students with learning difficulties. Which tactics can you identify as representative of your methods this year? Which would you like to use more often? The emerging research does suggest that the more we use these ideas, the stronger our instruction in reading will be. Which new ideas would you like to try?

A BRAIN-BASED MODEL OF READING

Although no one argues that teachers should become "brain experts," a general insight into the basic brain processes involved in reading does help to understand many types of reading difficulties for students with learning difficulties. As noted previously, reading is a very complex process. We believe that reading instructional strategies for students with learning difficulties should be presented within the context of this broader emphasis on brain compatible instruction. Further, Sousa's model of the reading brain can provide teachers with numerous insights for instruction, as well as a guide for selection of strategies and tactics for students with reading problems who may demonstrate different instructional needs within the class. Sousa (2001) presented this model in his work, *How the Special Needs Brain Learns.* Within Sousa's model of the reading brain, four areas of the brain, working simultaneously, seem to be most

heavily involved in reading: the visual cortex, Wernicke's area, the angular gyrus, and Broca's area (Sousa, 2001).

Beginning on the left of the top section of the model of the reading brain in Figure 1.1, the brain perceived the word *dog* via the visual cortex, which is located at the rear of the brain. The actual brain areas are shown on the sketch of the brain in the figure, which presents both the left and right hemisphere of the brain. The visual stimulus *dog* is immediately transferred to several parts of the brain. These include the angular gyrus, which is involved in this process of phoneme interpretation (Joseph et al., 2001). Next both Broca's area and Wernicke's area become involved in interpretation of those phonemic sounds into meaningful sounds, combinations of sounds, and word. Wernicke's area has traditionally been associated with various types of language function, including auditory processing, comprehension of words, and deriving meaning from words (see Joseph et al., 2001; Sousa, 2001).

Next, Broca's area becomes involved in the translation of the sounds into meaningful language. Broca's area has been associated with not only language, but also grammar and syntax, so while Broca's area is involved in the linguistic aspects of reading a one-word stimulus such as *dog,* it is also searching for and identifying meanings for this word, as well as relationships and meanings that relate this word to other previously read words. Thus, Broca's area is believed to be the language area in which meaning is attached to the stimulus word, *dog.*

Notice that, from the outset, several areas of the brain are heavily involved in the process of reading, that is, the process of translating graphemes (letters on the page) into phonemes (sounds). Even when a student is reading silently, this translation into letter sounds takes place in the brain during the initial stages of reading, and mistranslation can take place throughout this system, leading to reading errors. Of course, one must realize that while these four major areas of the brain are involved in noting the word, decoding the word by

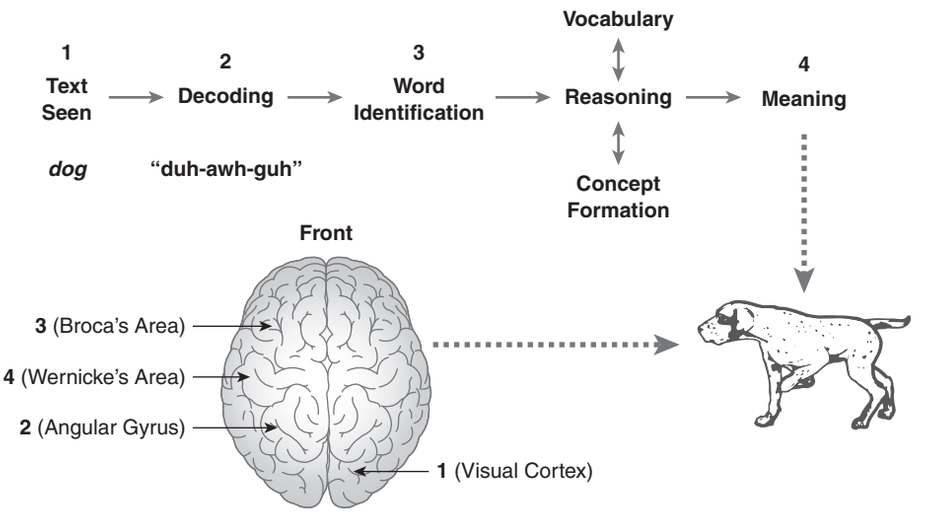

Figure 1.1 Sousa's Model of Reading

SOURCE: Sousa (2001).

sounding it out, and attaching meaning to the word, the eyes and brain continue to scan the page for other words to begin the process all over again. Thus, this word reading process is repeated many times each minute when a student reads, and often the eyes and visual cortex are scanning a word prior to the association of meaning with words read previously. Therefore, the timing of these mental processes becomes involved in reading, and the process becomes even more complex. In fact, with only one or two misread letters or words, the reading process can become very confusing.

REFLECTIVE EXERCISE 1.4
TEACHING STUDENTS ABOUT THEIR BRAINS

Prigge (2002) suggested that teachers should teach students with learning difficulties about their brains. For example, even young children can be taught the importance of water, appropriate sleep, appropriate diet, and so on, whereas older children can be taught to informally assess their own learning styles and preferences. Knowledge of one's learning styles and preferences can assist students with learning difficulties in understanding how they should study textual material or prepare for exams.

As a guide for instruction about the brain, the ten tactics for brain compatible classrooms could be used initially. Also, many interesting Internet research possibilities could be explored. The Web site at www.brainconnection.com, for example, provides a series of brain diagrams that can be used as worksheets for identifying various parts of the brain. As an interesting activity, you may wish to develop several lesson plans for instruction on how the brain thinks (or reads) based on this information, Sousa's (2001) model of the reading brain, and the sample worksheets at the Web site mentioned above.

For students who manifest reading difficulties, reading problems can occur at any point in this highly interactive reading process (Sousa, 2001, 2005). Perhaps because of quick scanning, a child thinks he or she sees the word *bale* instead of the word *tale* in a sentence—the visual cortex has thus introduced an error into this complex process that will, in all probability, lead to a lack of comprehension on the other end. Alternatively, either Wernicke's area or Broca's area could introduce an error with any word read, which will also lead to comprehension problems in the final reading of the text.

With this level of reading complexity in mind, this book will follow the basic processes of the brain noted above, emphasizing specific instructional tactics that may be associated with each major area. First, reading strategies will be presented that assist students in mastering the decoding auditory processing skills that emerge somewhat early in this reading sequence. Specifically, Chapters 2 and 3 present information on phoneme-based instruction and phonics, respectively, two sets of skills that are heavily involved in auditory processing, which takes place in Wernicke's area and the angular gyrus, as noted above. Chapters 4, 5, and 6 present information on vocabulary development, reading fluency, and reading comprehension during reading instruction in the lower grades, and reading comprehension in elementary and middle grades. This comprehension

emphasis corresponds to the later involvement of Broca's area in the reading process. Thus, this overall model of the reading brain will serve as an organizer for the remainder of this book of reading strategies in various reading areas.

WHAT THE BRAIN RESEARCH ON READING HAS FOUND

With this model of the reading brain as a basis, several specific results from the emerging brain research on reading can assist teachers in understanding the reading performance of students with reading problems in the lower and middle grades. Also, this brief list of research results emphasizes the contributions of the brain research to reading instruction. These research conclusions by no means represent the extent of understanding from research on the reading brain, but these results are interesting and some may surprise you. Further, these research findings can inform teachers on how we should manage students with reading problems in our classes.

Reading Problems May Be Speech-Timing Problems

Brain research on students with reading problems and learning disabilities has shown that a dysfunction in how the brain processes information concerning letter sounds or speech sounds may lead to reading problems. In fact, when one group of researchers used a computer program to pronounce words more slowly than normal, some children with reading problems were able to advance their reading levels by two years in only four weeks of training (Tallal et al., 1996). Thus, their reading problem was a brain-based, language-timing problem—they needed to hear the words more slowly than usual to process the information, even when they themselves were doing the reading. This would seem to implicate Wernicke's area—the auditory processing area—in the reading problems of some students with reading difficulties. Recently, a number of phonemically based, computer-delivered reading programs have incorporated these findings into a practical reading curriculum by allowing teachers to vary the timing on pronunciation of phonemes and/or syllables while students learn to read. These include programs such as Fast ForWord and Academy of Reading by AutoSkill.

Poor Readers Often *Are* Trying Harder

Have we, as teachers, ever told a student to "try harder" in reading? While encouraging students in their reading efforts is essential, recent brain research suggests that teachers of students with learning difficulties may wish to find another phrase to use. Brain scans have shown more frontal lobe activity in the brains of poor readers than in the brains of good readers. In fact, these data show that poor readers are putting forth additional effort—indeed more effort than good readers—in decoding. For example, many students with reading problems subvocalize (e.g., softly pronounce) what they read to interpret words correctly (Sousa, 2001; Tallal et al., 1996). This work requires extra brain processing and can be shown using fMRI technology among many students with reading difficulties.

This sheds new light on the admonishment from teachers or parents for students with reading problems to "try harder." For poor readers, the automaticity with the alphabetic code that good readers have developed is not yet present; consequently, these poor readers are, in many cases, already trying harder.

A further note is required on this research result. Because of a lack of automaticity with the alphabetic code, the reading problems of many poor readers tend to grow and compound. Thus, students who have not developed automaticity with phonemes, letters, or letter sounds will experience increasing problems in reading throughout the elementary and middle school years.

Letters Can Be Confused Because They Sound Alike

The brain essentially pronounces phonemes associated with specific letters during the early decoding process—transferring phonemes into graphemes—and this process, if not successful, can result in reading problems. While early research in dyslexia concentrated on letter confusion as a visual processing problem (e.g., confusing *b* and *d* because these letters look similar), recent research in dyslexia has implicated the angular gyrus, the location for interpreting letters that sound alike, as the basis for some letter confusion problems. In addition to looking alike, the letters *b* and *d* also sound alike, and if the angular gyrus mistranslates one of these letters in a particular word or text, a reading error will occur. Thus, a problem of the dyslexic reader, which previously was viewed as a visual discrimination problem involving these two mirror image letters, may in fact be an auditory discrimination problem based on the similar sounds they represent. In that context, the term *dyslexia* takes on an entirely new meaning—a language-based reading problem!

Nonlinguistic Deficits May Cause Some Reading Problems

We like to think that most reading problems are caused by language deficits, and language problems do result in reading problems. However, we now know that nonlanguage problems (i.e., nonlinguistic deficits) can also cause reading problems. Wright, Bowen, and Zecker (2000) suggest that auditory problems in the perception of sequential sounds can lead to reading problems. In effect, while reading a passage, the child may be subvocalizing and if certain sounds are held in auditory memory too long, the letters those sounds bring to mind may actually be superimposed over other letters, resulting in considerable reading confusion. This would represent a problem in Wernicke's area involving auditory processing. Further, this type of reading problem will create numerous errors in reading.

Some Reading Interventions Result in Measurable Changes in the Brain

Research has shown that reading begins at the phonemic level (Sousa, 2005), because brains detect and interpret phonemes, independent of viewing letters. Brains detect phonemes all the time when listening to others speaking, and consequently, reading begins, in some fundamental sense, with listening to the language of others, and generating language oneself. Consequently, it

should come as no surprise that effective reading interventions impact a brain's actual processing, but only recently have we had various technologies that would allow neuroscientists to measure those changes in brain function (UniSci, 2000). As one example, research has shown only recently actual changes in brain functioning resulting from as few as 15 two-hour reading instruction sessions in a phonologically driven instructional treatment involving systematic instruction in analysis of the structure of spoken and written words (Richards et al., 2000). We are at a point today when measures of actual brain functioning can tell us which reading intervention programs work best, and what this research has shown is that reading programs should be phonemically based. More on these exciting discoveries is presented below in this chapter.

These findings represent only a few of the notable research results from the brain research on reading and are presented only to show the types of insight that can be derived from powerful new research technology. In fact, various authors have identified other reading problems that have been identified using the newly developed fMR1 technologies (Joseph et al., 2001; King & Gurian, 2006; Leonard, 2001; Richards et al., 1999, 2000; Shaywitz et al., 1996; Sousa, 2005; Tallal et al., 1996), and this area of research will continue to lend insight into the reading problems noted among students with reading difficulty.

RESPONSE TO INTERVENTION: THE NATIONAL MODEL

What Is RTI?

Given recent research on the reading brain, coupled with the increasing national emphasis on reading instruction, teachers today must understand the newly emerging response to intervention instructional model. This has become the model for reading interventions across the nation in programs such as Reading First, and RTI is now allowed by the federal government as one option for identification of students with learning disabilities (Bender & Shores, 2007). Although RTI can be used to document a student's learning disability, as described below, the basic emphasis of RTI is remediation of reading problems prior to diagnosis of a disability.

Traditionally, learning disabilities were identified by noting a difference between an IQ score and a reading achievement score for a particular child. Whereas other academic scores were sometimes used, in well over 90% of the cases, learning disabilities were diagnosed on the basis of reading deficits (Bender, 2008). In short, if a child had an IQ score that was considerably higher than his or her reading score, coupled with some indication among the IQ subtest scores of various auditory or visual processing problems, a learning disability was believed to exist. Over the years, many researchers expressed dissatisfaction with this diagnostic procedure, and in 2004, the federal government passed legislation that allowed the use of another procedure, commonly referred to as response to intervention, or RTI. Note that the federal legislation does not mandate RTI, but rather, allows RTI as an indication of a learning disability. Subsequent research (Barkeley, Bender, Peaster & Saunders, in press) has indicated that most states are implementing RTI statewide, or pilot testing RTI as an eligibility tool for documenting a learning disability.

Using an RTI process, schools will be required to document how a child responds to several scientifically based educational interventions. It is hoped that more intensive educational interventions will meet the needs of most children, who will not then be documented as learning disabled. However, should a child not respond to two or more scientifically based reading interventions, that child may be suspected of having a learning disability.

What Does RTI Look Like?

The RTI process is typically described in terms of a pyramid that includes multiple tiers of instructional interventions (Barkeley et al., in press; Bender & Shores, 2007; Fuchs & Fuchs, 2007; Kemp & Eaton, 2007), and most models involve three such intervention tiers, as presented in Figure 1.2. The purpose of the multiple tiers is to document that the child had more than one opportunity to respond to a scientifically based reading curriculum, when instruction was presented in an appropriate fashion, consistent with the instructions in the teacher's manual. To protect the interests of the child, and prevent a diagnosis of learning disability based on only one supplementary instructional intervention, every model used in the various states and described in the instructional literature mandates a minimum of two supplemental instructional interventions prior to a diagnosis of learning disability (Barkeley et al., in press). These multiple intervention tiers are required to ensure that the child had several adequate opportunities to respond to instruction.

In the RTI procedure, a student who is struggling in reading is identified by the general education teacher, who then provides supplementary, more intensive instruction as the tier one intervention. Note that this intervention must be offered as a supplementary intervention in reading—not a replacement for the reading class, and it must be more intensive than the intervention provided for all students in the general education class. As indicated in Figure 1.2, the instruction provided for all students in the general education class is believed to meet the instructional needs of approximately 80% of all students.

Whereas most learning needs for most struggling students can be addressed at the first intervention tier, some students will not progress adequately, even

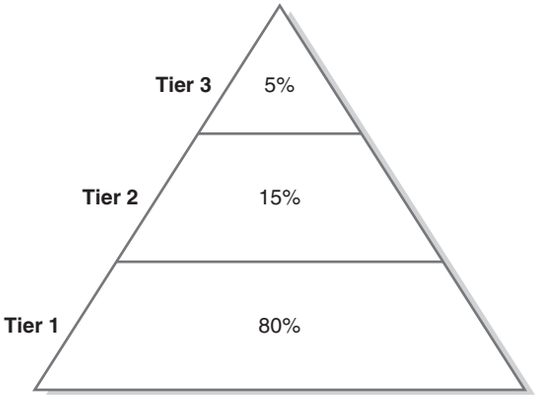

Figure 1.2 RTI Pyramid of Interventions

with the supplemental intervention. These students will require a second, more intensive tier of intervention, which may involve small group instruction for an additional period each day. This tier two intervention, in some school districts, will be a function of the student support team, and while it will be managed by the general education teacher, most districts are providing considerable support for teachers to meet this need for more intensive interventions for a limited number of students in the classroom. While one may expect 20% of students to be exposed to tier two, the tier two intervention adequately will meet the needs of some 15% of the school population (Bender & Shores, 2007).

Finally, for students who do not progress in the first two intervention tiers, another more intensive intervention will be required. In some cases, school districts are viewing this third tier of intervention as an intervention that is provided in the context of special education, and is thus offered only after a child has been identified as learning disabled. Other districts, however, are presenting this third intervention tier as a general education intervention tier that is more intensive than the first two interventions, but still managed by general education teachers, with the support of perhaps a reading specialist or an inclusion teacher who is co-teaching in the same classroom. Approximately 5% of students are expected to need a third intervention tier.

Issues to Consider in RTI

Teachers should be aware of a number of issues when they plan for implementing RTI interventions. First, this is the first time in history in which the interventions managed by the general education teacher will play such a significant role in determining the eligibility of students for learning disability status. Although general education teachers have been sitting on child eligibility teams for decades, only under RTI do general education teachers provide one of the two most critical pieces of data documenting the eligibility—a chart of the child's daily or weekly performance in response to the first targeted intervention.

Next, many different models of RTI currently are being implemented. For example, the three-tier model described above is being used in Texas, whereas both Georgia and North Carolina are implementing a four-tier model. Teachers should check with their own state department of education and school district to obtain a description of the RTI model used in their district.

One issue will be how general education teachers can make the time to undertake these additional interventions. In a typical third grade class, with 24 students, there may be five to six students who are struggling in reading, and those students will need a tier one intervention, which is provided above and beyond their typical reading instruction. Moreover, the general education teacher in that class is expected to provide that intervention, monitor the weekly or daily performance of those students, and be prepared to present those data (which are typically presented in the form of an *x-y* axis chart with days or weeks at the bottom and achievement on the side) to the student support team in a matter of weeks. Finding or making the time to do that is a critical concern, and fortunately technology can assist. Once teachers identify students who need the tier one or tier two intervention, teachers may be able to find and implement a computer-based reading program, such that the teacher can

continue teaching the class, while those five or six students work on computer-assisted instruction on their targeted reading skills.

A final issue to consider involves treatment fidelity, which may also be referred to as treatment validity. This addresses the question, "Did this child receive instruction that was presented as it should have been presented, or in accordance with the instructor's manual for the curriculum used?" Clearly, even the best scientifically validated curriculum is not effective unless it is taught appropriately, and if it is not implemented appropriately, the child will not have an appropriate opportunity to respond to instruction. Thus, educators will have to address the issue of treatment fidelity in the RTI process (Bender & Shores, 2007).

As can be seen from the discussion above, solutions for a number of issues on implementation of RTI have not been determined as yet, and in all likelihood, various districts will develop different approaches to RTI. What is certain is that general education teachers will be playing an increasing role in documentation of the effectiveness of reading instruction for students suspected of having a learning disability, and we must all prepare for that.

One major purpose of this text will be to describe various RTI procedures in reading and relate these to various reading strategies. These case studies will vary according to the content of the chapter. For example, a phonemically based tier of interventions will be presented in the next chapter, while subsequent chapters will present RTI procedures dealing with phonics, reading fluency, or reading comprehension. Also, this text will present a number of instructional procedures that can be the basis for interventions in the RTI process. This should help all general education teachers prepare for the full and complete implementation of RTI.

CONCLUSION

This chapter has presented a series of research-based conclusions on the development of reading skill, as well as several areas within which reading instructional strategies may be discussed: early literacy instruction, brain compatible instruction, and RTI. A series of general research results has been presented in each of those areas, as those results provide a further framework for the strategies discussed throughout this book. Finally, the RTI model presented here will serve as our organizer for the remainder of the book, as we present research-based reading strategies and suggest how those might fit into an RTI procedure. Each subsequent chapter will include at least one RTI case study, and these may be used as models for educators struggling to implement RTI.

WHAT'S NEXT?

In the next chapter, you will find a series of instructional strategies to enhance phoneme awareness and phoneme manipulation skills among students with reading difficulties. These skills are essential for the effective auditory processing of letter sounds, which takes place in the angular gyrus and Wernicke's area of the brain. Further, these skills also serve as a basis for all subsequent reading. The RTI example in that chapter will focus on early literacy skills for kindergarten teachers, involving phonemic recognition activities.

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