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 GOOD NEWS IN READING RESEARCH!

While the initial picture of reading success among students with learning disabilities and other reading difficulties, as presented by the National Reading Panel [NRP], is not overly positive, there is good news to report (National Institute of Child Health and Development [NICHD], 2000). Research on reading instruction has exploded in the past two decades, resulting in major advances in several related areas including biological bases for reading, literacy instruction, phonological awareness research, and reading comprehension instructional tactics for students with reading difficulties (Chard & Dickson, 1999; Joseph, Noble, & Eden, 2001; Sousa,
2001; Sylwester, 2001; Wood & Grigorenko, 2001). Much of this research 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 in it—readily available to every elementary and middle school teacher in the classroom.

Within this growing body of research, two 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) and the growing literature on brain compatible reading instruction (Prigge, 2002; Sousa, 2001; Sylwester, 2001). Each of these emphases is presented below in order to provide a backdrop for the strategies discussed in this and each subsequent chapter. First, a brief synopsis of the general reading research is presented.

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, 2001; NICHD, 2000). 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 in order to provide a basis for discussion of the reading strategies and tactics for students with reading problems (Kameenui, Carnine, Dixon, Simmons, & Coyne, 2002; NICHD, 2000; Sousa, 2001). 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; of course, a human infant isolated on an island probably will 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 early and middle school years.

There Is No “Reading” Area in the Brain

While 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. While speech and language seem to be “hard-wired 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 which 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 as possible genetic problem areas for students with learning disabilities—particularly chromosomes 1, 2, 6, 13, 14, and 15 (Raskind, 2001). However, much more research is needed prior to isolating a specific genetic basis for either learning disabilities or reading disabilities. Further, while 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 and tactics for enhancing reading, 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. A phoneme is the briefest discrete sound which can communicate meaning in the English language. Some research reports 41 phonemes in English (NICHD, 2000), while other research suggests there are 44 (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.

**Students Must Learn the Alphabetic Principle and the Alphabetic Code**

The *alphabetic principle* involves both the fact that some speech sounds can be represented by letters and the ability to decode unknown words based on those letter–sound relationships. The *alphabetic code* represents the relationships between letters and the sounds they represent. Research has documented that students with learning disabilities must learn the alphabetic principle in order to read effectively across the grade levels; merely memorizing words and word meanings is not enough for successful reading long term (Kameenui et al., 2002). Further, the alphabetic principle is not learned merely from exposure to print, but must be specifically taught (Sousa, 2001).

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

While debate has raged for decades over phonics versus sight word instructional techniques (this debate is discussed in more detail in Chapter 4), the evidence has clearly shown that an emphasis on phonics, as represented by the alphabetic principle (i.e., 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, in order 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” (Kameenui 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.

**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 ideas 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**

With these big ideas from the reading research noted, a new emphasis on early literacy instruction—versus merely an emphasis on reading—has emerged (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 & Pettigrew, 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 letter-sound 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 (Bos et al., 2000; NICHD, 2000; Patzer & Pettegrew, 1996; Smith et al., 2001). The research supports the use of oral reading or choral reading as an instructional technique to enhance reading fluency, since reading is dependent upon a student’s language ability. Also, oral reading practice is recommended since 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 (Kame’enui et al., 2002). In point of fact, students who miss early phonological instruction will always 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 student outcomes 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 which 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 (Kameenui 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.

REFLECTIVE EXERCISE 1.2
DEVELOPING LITERACY INSTRUCTIONAL SYSTEMS

With the emerging emphasis on literacy during 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 through 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).
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.

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

<table>
<thead>
<tr>
<th>Skill</th>
<th>Milestone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Development of oral language</td>
<td>Birth to 24 months</td>
</tr>
<tr>
<td>Phoneme discrimination</td>
<td>Birth to 11 months</td>
</tr>
<tr>
<td>Says first words</td>
<td>6 months to 11 months</td>
</tr>
<tr>
<td>Follows simple verbal directions</td>
<td>12 months to 17 months</td>
</tr>
<tr>
<td>Pronounces first vowels and most consonants</td>
<td>18 months to 24 months</td>
</tr>
<tr>
<td>Enjoys having a story read</td>
<td>18 months to 24 months</td>
</tr>
<tr>
<td>Awareness of certain letters (such as letters presented in</td>
<td>24 months to 36 months</td>
</tr>
<tr>
<td>advertising; i.e., M stands for McDonalds and K for Kellogg’s)</td>
<td></td>
</tr>
<tr>
<td>Complex phoneme manipulation</td>
<td>48 months to 8 years</td>
</tr>
<tr>
<td>Can tell a story</td>
<td>36 to 48 months</td>
</tr>
<tr>
<td>Becomes aware of the alphabetic code (i.e., letters stand</td>
<td>48 months to Grade 1</td>
</tr>
<tr>
<td>for specific sounds)</td>
<td></td>
</tr>
<tr>
<td>Begins to read first words</td>
<td>48 months to Grade 1</td>
</tr>
<tr>
<td>Can grasp meaning from reading short paragraphs</td>
<td>Grade 1 to Grade 3</td>
</tr>
<tr>
<td>Begins to comprehend longer texts</td>
<td>Grade 1 to Grade 3</td>
</tr>
</tbody>
</table>

Development of Early Literacy Skills

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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 McDonalds. 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 greatly will 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 the following teaching tip.

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 below. Teachers should feel free to alter or adapt these checklists to exclude or include any skills relevant for a particular student.
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: 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 free from http://DIBELS.uoregon.edu. While 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. (We particularly enjoy sharing information on materials that can be obtained free of charge!) On that basis, we recommend that every teacher of kindergarten through Grade 3 take the time to download this informal assessment of early literacy skills. Downloading this assessment can take some time, however, so it has also been made available for purchase from Sopris West, in Longmont, Colorado.

DIBELS is a research-based assessment and 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.

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 (Haager, 2002). Other stepping stones through the first several years of school, such as those presented below, represent similar benchmarks.

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Timeframe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Onset fluency (initial sounds)</td>
<td>Two months into kindergarten</td>
</tr>
<tr>
<td>Phoneme segmentation fluency</td>
<td>End of kindergarten</td>
</tr>
<tr>
<td>Nonsense words fluency</td>
<td>Middle of Grade 1</td>
</tr>
<tr>
<td>Oral reading fluency</td>
<td>End of Grade 1</td>
</tr>
</tbody>
</table>

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 at the times mentioned above, reading problems are quite likely to develop. Thus, in order 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.

**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 decade and is based primarily on improvements in the medical sciences (Leonard, 2001; Prigge, 2002; Sousa, 2001; Sylvester, 2001). In fact, much of our increasing understanding of the human brain has come from the development of the functional magnetic resonance imaging techniques (a technique which is sometimes represented in the literature as the fMRI). This is a nonradiological technique—and thus a relatively safe brain-scanning technique—which has allowed scientists to study the performance of human brains while the subject concentrates on different types of learning tasks (Richards, 2001).

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, 2001). 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).

Finally, many researchers have suggested that the research has developed to a point where specific teaching suggestions may be made. 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, 2001). While various authors make different recommendations, the 10 tactics for a brain compatible instruction classroom, presented in the teaching tip below, 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, 2001).
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.

(Continued)
Teaching Tip 1.3 (Continued)

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.

(Continued)
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.

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.

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**A BRAIN-BASED MODEL OF READING**

While no one argues that teachers should become “brain experts,” understanding the basic brain processes involved in reading does help
to understand some 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*—a work that concentrates on students with learning disabilities and other learning difficulties. 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 model of the reading brain (see 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 below, which presents the left hemisphere of the brain. The visual stimuli *dog* is immediately transferred to several parts of the brain simultaneously. These include Wernicke’s area, which traditionally has been associated with various types of language functions including auditory processing and comprehension (see Joseph et al., 2001; Sousa, 2001), as well as the angular gyrus, which has been proposed as the primary location for written language (Joseph et al., 2001). Some believe that the
angular gyrus is involved in this process in order to provide insight into what letters would be used to represent the specific sounds noted by Wernicke’s area. Notice that, from the outset, several areas of the brain are heavily involved in the process of reading—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.

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.

Of course, one must realize that while these four major areas of the brain are involved in noting the word, decoding the word by 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 10 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 which 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 model of the reading brain, and the sample worksheets at the Web site above.

For students who manifest reading difficulties, reading problems can occur at any point in this highly interactive reading process (Sousa, 2001). 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 the error with any word read, which will 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 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 which 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 on 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 reading more slowly than usual in order 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.

**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, teachers of students with learning difficulties may wish to find another phrase to use, based on recent brain research. 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 in order to interpret words correctly.
This work requires extra brain processing and can be shown using fMRI technology among many students with reading difficulties. Thus, in many cases, because of the difficulty of the reading material, poor readers are reading harder than are good readers who are reading the same material.

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

A further note is required on this research result. Because of this 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 letters and 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 which 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 mis-translates 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.

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 this powerful new research technology. In fact, various authors have identified other reading problems that have been identified using the newly developed fMRI technologies (Joseph et al., 2001; Leonard, 2001; Tallal et al., 1996), and this area of research will continue to lend insight into the reading problems noted among students with reading difficulty.

CONCLUSION

This chapter has presented a series of research-based conclusions on the development of reading, as well as two broad areas within which reading instructional strategies may be reviewed: early literacy instruction and brain compatible instruction. A series of general research results has been presented in each of those areas, since those results provide a further framework for the strategies discussed throughout this book. Finally, the model of the reading brain, which was proposed and developed by David Sousa (2001), will serve as our organizer for the remainder of the book.

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 Wernicke’s area of the brain. Further, these skills also serve as a basis for all subsequent reading.

REFERENCES


