On the Nature of Reading

THE IMPORTANCE OF LEARNING TO READ

Literacy is a relatively recent addition to human culture. Humans have used oral language for perhaps 4 million years, but the ability to represent the sounds of language by written symbols has been around for only 4,000 to 5,000 years. Until the twentieth century, nearly every human on earth was illiterate. However, the expectation in today’s society is that 100 percent of the population will be able to read and comprehend. We live in a society where the development of reading skills serves as the primary foundation for all school-based learning. Those who do not read well find their opportunities for academic and occupational success are severely limited. Although the expectation that all children will read and comprehend is understandable, we are a long way from reaching this goal.

According to the National Center for Educational Statistics (1998), 38 percent of fourth graders in the United States cannot read at a basic level. This means they cannot read and understand a short paragraph of the type found in a simple children’s book (Lyon, 2001). A child who is not at least a modestly skilled reader by the end of third grade is unlikely to be a skilled reader in high school. In fact, research has shown that we can predict, with reasonable accuracy, students’ future academic success by their reading level at the end of third grade (Slavin, 1994).

Lack of skill in reading also has a potent effect in other areas. Surveys of adolescents and young adults with criminal records indicate that at least half have reading difficulties. Some states actually predict their future need for
prisons by fourth-grade reading failure rates (Lyon, 2001). Similarly, nearly 50 percent of youths with a history of substance abuse have reading difficulties (National Institute of Child Health and Human Development, 2000). An increasing proportion of children are labeled “learning disabled,” with most being identified because of difficulties in learning to read. There are those who believe the special education population in our schools could be reduced significantly by giving more attention to early interventions designed to prevent reading problems (Kotulak, 1996).

WHY LEARNING TO READ IS SO DIFFICULT

Our biological destiny is speaking, not reading. Speaking is a natural development; reading is an unnatural act. This means that almost every child will master speech just by spending time with people who already speak. Spoken language has become “hardwired” in the brain with structures built specifically for language. There are no naturally designated neural mechanisms for reading, however, so the brain must co-opt structures designed for other purposes. As the eye chases the words in a sentence across the page, the brain must continuously use neural systems designed by nature for entirely different tasks, such as looking for food or predators.

Even though reading is an acquired skill and not a natural process, most people do become fluent readers, but not without a lot of work. Learning to read is a long, gradual process that begins in infancy. Basic competency usually is not reached until middle childhood. As reading researcher Sally Shaywitz, professor and director of the Yale Center for Learning and Attention, states, “Reading is the most complex of human functions” (Shaywitz, 2003).

Reading in any language poses a challenge, but reading in English is particularly difficult. For example, some language systems, such as the Japanese katakana, are based on a system where each syllable is represented by a written symbol. When these symbols are learned, the child can read with relative ease (Snow, Burns, & Grifﬁns, 1998). Spoken English, on the other hand, has approximately 5,000 different possible syllables. Written English uses a system of letters—an alphabet—to make up a spoken syllable. A letter alone does not refer to anything. It must be combined with other letters to represent a
meaningful unit or syllable. The child must learn this complex alphabetic system in order to be able to decipher written words.

Reading in English is further complicated by its orthography—the spelling of words. In some languages, such as Spanish, one letter has one sound. In English, one letter can represent several different sounds, depending on its placement in the word. It is understandably difficult to figure out the sound-symbol relationship when the sound of a particular letter changes in words that have the same root but different suffixes. The sound of the “g” in the words “college,” “collegial,” and “colleague” is an example. Another complicating factor in English is the retention of historical spellings such as the “gh” in ghost (which is pronounced differently from the “gh” in neighborhood) and the “ph” in geography. Many other examples of spelling patterns that make the sound-symbol relationship so difficult to understand come easily to mind.

Some Learn to Read Easily, Others Don’t. Why?

We would be willing to bet that most people do not remember more than the sketchiest details of the process they undertook in learning to read. They may remember the alphabet chart strung across the front of the classroom, their basal reader, the teacher writing a story as they dictated, or matching pictures to words on a worksheet. Nevertheless, they probably have no memory of how and when they finally made sense out of the written symbols to the point where they could read fluently and comprehend what they were reading.

What eventually happens to all fluent readers is that the process of decoding becomes automatic. They decode without conscious thought. This ability to carry out an act unconsciously occurs not only in reading, but in many other habits and skills such as driving a car, tying shoelaces, playing the piano, or swinging a golf club. When someone first learns a skill, every aspect is consciously attended to. But over time, and with a great deal of practice, the brain “remembers” how to carry out all the procedures involved in the skill, allowing it to attend consciously to something else. This type of automatic processing is called unconscious or implicit memory. It comes into play in reading by allowing the reader to concentrate on the meaning of what is being read without having to think about deciphering every word. The downside to this
unconscious memory is that knowledge about how this unconscious task is accomplished becomes very difficult to access. As a result, there has been no clear picture of the processes and procedures involved in learning to read. This partially explains the amount of intense debate over which teaching methods work best.

In order to become a fluent reader, certain pre-reading skills need to be mastered, but emergent readers do not all learn these skills in the same way and at the same rate. A small percentage of children learn to read on their own with no formal instruction before they enter kindergarten. Others learn to read fairly quickly once exposed to instruction. However, too many children struggle throughout their school careers, never learning to read well enough to comprehend what they are reading. Why this disparity? The answer to this question is complex. However, to begin to understand reading difficulties, two major factors, one biological and the other environmental or instructional, need to be explored.

Some Problems Have a Biological Basis

One possible reason that some children have difficulty learning to read is that these children have a biological or neurological deficit. As neuroscience research has expanded, researchers are acquiring a better understanding of what goes on in the brain when one reads. Using brain-imaging techniques, scientists now have a tentative picture of the brain components involved in reading. A problem with any of these structures has the potential to affect a child’s ability to read. Dyslexia, for example, appears to have a biological basis. While specific structures involved in this disorder are often difficult to pinpoint, Sally Shaywitz and her colleagues are beginning to make progress in identifying parts of the brain that play a role in this disorder. This and other research on dyslexia will be addressed later in this book.

Occasionally, adverse pregnancy or labor events can cause severe learning and/or reading problems (Berninger & Richards, 2002). Auditory and/or memory processing difficulties—found in an estimated 20 percent of all children—are additional causes of reading problems (Honig, 2001). Genetic factors have also been implicated in some reading disabilities (Pennington, 1989; Scarborough, 1989). Hearing or visual impairment, verbal memory problems, and attention deficit/hyperactivity disorder (ADHD) are other risk factors.
Looking at genetic and biological factors, it is easy to see why we might assume that a child’s intelligence quotient (IQ) would determine future reading success. This, however, does not appear to be the case. The results of a number of empirical studies on the correlation between IQ and reading achievement have shown that IQ is not a strong predictor of reading achievement, unless we are looking at children with severe cognitive deficiencies who usually develop very low, if any, proficiency in reading (Stanovich, Cunningham, & Cramer, 1984).

Care needs to be taken when attributing reading problems purely to biological factors. Discovering that a child has a brain system that is not functioning correctly says little about the possibility for remediation. Young children’s brains are remarkably plastic or open to change. Biological factors can be altered by the environment, in this case by the reader’s experiences, which leads to the second set of factors influencing whether a child becomes a fluent reader—environmental factors.

Other Problems Stem From Environmental Factors

Unfortunately, many children are capable of learning to read but do not because of environmental circumstances. Three major categories of circumstances influence whether children with no biological deficits will reach their reading potential.

Instructional Factors. If the instruction provided by a school is ineffective or inefficient, a child’s progress in learning to read will likely be impeded. Without a thorough understanding of the processes involved in reading, it is difficult to design an effective reading curriculum or methods for teaching. There has been little consensus on curriculum or instructional methods, resulting in huge pendulum swings with first one program and then another promising to make all children fluent readers. Debates have raged over which method “works.” The recent whole-language versus phonics debate is an example.

Publishers of reading programs have understandably followed the swings, often with little or no understanding of the processes involved in learning to read. Some published materials are poorly constructed and even contain inaccuracies. To add to the problem, programs are often adopted by uninformed committees based on the attractiveness of the illustrations or the number of workbooks and other supplemental materials they provide. Let’s face it, educators have not always been the most credible consumers of appropriate curriculum, the authors included!
Why are educators uninformed consumers? One problem is that even when research has provided good information on reading instruction or evidence of the potential effectiveness of a particular program or methodology, the results seldom find their way into the schools. Many teachers assigned to teach reading have had little instruction in the theoretical and biological underpinnings of the reading process. The fact that many teachers are not well prepared to teach reading is a critical issue, as much research supports the importance of the teacher (Allington, 1989; Dykstra, 1967). Alan Farstrup, executive director of the International Reading Association, states, “The expert teacher, professionally trained and experienced in delivering excellent reading instruction, is the most important variable in achieving reading success” (Farstrup, 2000).

Although the selection of reading programs is important, not all reading programs are equally effective in all situations. Teachers’ abilities to identify the individual needs of their students and adjust their instruction accordingly often determine whether a particular program will be effective.

When poor instruction occurs consistently, especially in the first year, many students are likely to fall behind. Even if students are exposed to adequate instruction in subsequent years, there is evidence that poor instruction in first grade has long-term effects (Pianta, 1990). Several studies have documented that the poor first-grade reader continues to be a poor reader (Francis, Shaywitz, Stuebing, Shaywitz, & Fletcher, 1996; Torgeson & Burgess, 1998).

Socioeconomic, Ethnic, and Second-Language Factors. Children of all social, ethnic, and economic groups experience reading problems. However, failure to read well is more common among nonwhite children, poor children, and nonnative speakers of English. The reasons are complex. For example, Spanish-speaking students, who make up the largest group of limited-English-proficient (LEP) students in the United States, are particularly at risk. One obvious reason is the language difference itself, as evidenced by the fact that when these students are taught to read in Spanish, many achieve excellent reading capabilities. However, this is not the only explanation. Many children in good bilingual programs still fall behind their English-speaking peers (Slavin & Madden, 1994).

Low socioeconomic status (SES) also appears to play a role in reading achievement, although there is no consensus as to why. One possible explanation is that low-SES children tend to go to inferior schools where there are fewer educational opportunities. Another is that, unlike parents in middle-income homes, many low-SES parents provide fewer opportunities for informal literacy learning, defined as visits to the library, joint book reading, play with print, and independent reading (Baker, Serpell, & Sonnenschein, 1995).

Early Language Development. As we shall see in Chapter 3, there is a close relationship between reading and language. In some children, inability to achieve
reading proficiency seems to be attributable to a lack of exposure to language patterns and literacy-based interactions and materials during their early years (National Institute of Child Health and Human Development, 1998). According to author Jane Healy, too many children are being raised in a language-impoverished environment where they are seldom read or talked to and too much time is spent passively viewing television or playing video games (Healy, 1985). This environment develops receptive/listening skills but not the language skills that will be more important when the child begins formal reading instruction.

As with the development of all human abilities, genetic and biological factors cannot be dismissed or minimized in considering the ability to become a competent reader. However, whether a child becomes that reader is also dependent on the environment in which the child is raised. As author Ronald Kotulak so beautifully puts it, the genes are the building blocks of human development, but the environment is the on-the-job foreman (Kotulak, 1996).

**THE BASICS OF READING**

If teachers are asked to list all the skills a child needs in order to read, they might have some difficulty. As mentioned earlier, for nearly all adults, the act of reading has become an unconscious activity, its processes stored in a type of memory called implicit or unconscious memory. In the beginning, every step was a conscious process that had to be learned. Eventually, with a great deal of practice, reading gradually becomes a seamless, automatic activity carried out by the brain without conscious awareness. As with any task that has reached the point of being automatic, the act of reading is difficult to understand (and equally difficult to teach), unless we break it down into its component parts. Many studies have focused on the act of reading, attempting to define each skill in the complex task of becoming a fluent reader who comprehends the meaning of print. Even before children learn to read in the conventional sense, most have acquired information about the purposes and component skills of reading.

**Emergent Literacy Skills**

Some children on entering school and beginning formal reading instruction are much more successful than other children. What makes the difference?
Although—as was mentioned earlier—biological factors are sometimes involved, many times the reason for the differences can be traced to the children’s literacy development in the early years before they begin formal schooling.

Emergent literacy skills (sometimes called early childhood readiness skills or pre-reading skills) are terms used by both researchers and educators to describe the skills acquired in early childhood that prepare these children to gain the greatest benefit from formal reading instruction when they enter school. These emergent literacy skills have been shown to have a high correlation with later reading ability (Scarborough, 1989). The National Research Council states that reading is typically acquired relatively predictably by children who have normal or above-average language skills and have had experiences in early childhood that foster motivation and provide exposure to literacy in use (Snow et al., 1998).

We will begin by looking at two emergent literacy skills that appear to be highly predictive factors for reading ability. To the fluent reader, these skills may seem so commonsense as not to be worthy of mention, but they are critical. If ignored, they put at risk the child who is tackling the difficult job of decoding print.

### Knowledge About Books

It is easy to forget that young children do not necessarily know what a book is or how it is used. As we read to children, they learn how to hold a book and that it is opened at the beginning. Children also must learn that in English a book is read from left to right and that it is print, not pictures, that is being read. We take this latter skill for granted, but given the vivid and colorful illustrations in children’s books, it is easy to see why children might think the pictures are being read (Adams, 1990).

### Recognizing the Alphabet

English is an alphabetic language. Thousands of words are derived from a base alphabet of 26 letters. A predictive factor for learning to read is the fast and accurate skill of naming and recognizing these letters. According to Adams, who has done an exhaustive review of the research in this area, this skill is one of the best predictors of first-grade reading ability (Adams, 1990). Although many children are able to recite the alphabet song, letter knowledge goes beyond singing the song. Children must also be able to recognize the letters in many contexts—within words, handwritten or typed,
in different fonts, and so on. But accuracy of recognition alone is not enough. The speed at which they can reliably name individual letters appears to be the determining factor. Why are letter recognition and naming such good predictors of later reading success? The names of most letters are closely related to their sounds. As children learn to name the letters, they are beginning to learn their sounds as well. This leads to what Adams feels is the single most important thing children must understand when learning to read: the **alphabetic principle**, which is the understanding that letters have corresponding sounds that make words when combined (Adams, 1990).

**Reading Skills**

Reading is composed of two main processes: decoding and comprehension. These two processes are independent of one another, but both are necessary for literacy. Decoding involves being able to connect letter strings to the corresponding units of speech that they represent in order to make sense of print. Comprehension involves higher-order cognitive and linguistic reasoning, including intelligence, vocabulary, and syntax, which allow children to gain meaning from what they read. We will begin with a look at the component skills of the decoding process.

**Awareness That Speech Is Composed of Individual Sounds**

A discussion of reading requires that we communicate using a common vocabulary. However, the terms used to define the components of the reading process can sometimes be confusing. Consider the following terms: phonological awareness, phonics, phonemic awareness, cipher knowledge, syntax, semantics, lexical knowledge, graphemes, morphemes, onset and rime, and the alphabetic principle. Let’s begin with the term that is newest in the lexicon of reading vocabulary and is an essential element of decoding—phonemic awareness.

Although no magic bullet exists for mastering the complex skill of reading, there is a growing consensus that phonemic awareness is a critical piece of the puzzle. Many children appear unable to read well because they lack this skill (Adams, 1990; Clachman, 1991; Torgesen, 1993). Phonemic awareness is a relatively new term for many educators. Exactly what are phonemes and why is phonemic awareness so important? **Phonemes** are the smallest sounds of speech that correspond to the letters of an alphabetic writing system. They are the basic building blocks of spoken words. In English, there are an almost infinite number of possible words, but there are only about 40 to 44 phonemes. For example, the spoken word “cat” is composed of three phonemes, /c/, /a/, /t/.
and /t/. A new word can be made by deleting a phoneme (delete the /c/ to make the word “at”), replacing a phoneme (replace the /c/ with /b/ to make the word “bat”), or rearranging the phonemes (put the /t/ in the initial position to make the word “tab”).

**Phonemic awareness** is an understanding of the simple fact that a few phonemes can be arranged to make many different words. We want to emphasize that we are talking about spoken language and not to confuse phonemic awareness with awareness of print. How do you know if children have phonemic awareness? They can segment the sounds in words. For example, they can pronounce the first sound they hear in the word “tap,” or the last sound in the word “mop.”

Babies are born with the neural hardware to pronounce all the phonemes in English, as well as the sounds of all other languages. However, the sounds they hear repeatedly strengthen certain neural connections, while the neural connections for the ones they do not hear begin to fade away (Kuhl, Williams, Lacerda, Stevens, & Lindblom, 1992). Research has shown that as early as one month of age, infants distinguish between phonemes such as /ba/ and /p/ (Eimas, Siqueland, Jusczyk, & Vigorito, 1971). Before long, babies begin to produce the sounds (phonemes) of their native language, much to the delight of parents who reward their efforts with smiles and repeat the sounds back to the children. In this way, phonemes are encoded deeply in the brain. However, as with many skills and habits embedded in implicit memory, children are not consciously aware of their knowledge. As Marilyn Jager Adams states in her seminal book *Beginning to Read*, “To learn an alphabetic script, we must learn to attend to that which we have learned not to attend to” (Adams, 1990, p. 66).

**Phonological Awareness**

A term that is often confused with phonemic awareness is **phonological awareness**. This is a broader umbrella term that includes phonemic awareness and the additional skills of recognizing and producing rhymes, breaking words into syllables, distinguishing parts of syllables, and so forth. This latter skill involves identifying onsets and rimes. An **onset** is the initial consonant(s) sound of a syllable and a **rime** is the part of a syllable that contains the vowel and all that follows it in a syllable. For example, in the word “sit,” the onset is /s/ and the rime is /it/, and in the word “bag,” the onset is /b/ and the rime is
Phonological processing can be simple, as in the previous examples, or it can be more complex, such as detecting an accented syllable or determining the roots or prefixes of words.

Note that some authors and researchers do not use the term phonemic awareness. Instead, they use the term phonological awareness to represent the awareness of phonemes as well as awareness of syllables, onsets and rimes, and so on. Regardless of the terminology, it is important to emphasize that we are talking about the sounds of spoken language, not print. Activities and tasks to teach phonemic and phonological awareness at developmentally appropriate times will be addressed in Chapter 4.

The Alphabetic Principle

Thus far, we have been discussing children’s understanding of the sounds of spoken language. Phonemic and phonological awareness are prerequisites for the next stage in learning to read—an understanding of the alphabetic principle. Simply stated, the alphabetic principle is the understanding that there is a generally predictable relationship between the sounds of spoken language (phonemes) and the letters and spellings that represent those sounds in written language (graphemes). To master decoding, children must first make the connections between the sounds in speech and the printed symbols on the page. This insight does not come naturally to most children; it needs to be taught. The methods used to teach children that the sounds are represented by letters are called phonics. The term phonics often engenders visions of isolated drills, overreliance on worksheets, or rote memorization of phonics rules. Effective phonics instruction is none of these. As we shall see in a future chapter, for many children, systematic instruction in this stage of reading development serves the essential purpose of helping readers figure out as quickly as possible the pronunciation of unknown words, freeing them from relying excessively on pictures or context.

Fluency and Comprehension

We read for a purpose. As important as developing the ability to decode print is, it is a useless skill unless it results in a fluent reader who comprehends what is being read. The final step in reading is to be able to decode so automatically and unconsciously that the conscious processing functions of the brain are totally available for understanding the content of the print.

Fluency and comprehension are separate processes. A person can be a fluent reader without comprehending what is being read. For example, Jane Healy, in her

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Your Child’s Growing Mind, describes an unusual group of children, called hyperlexics, who teach themselves to read as early as 2 years of age. They read obsessively and fluently, but when tested for comprehension, they cannot understand the meaning of a first-grade story. Healy calls reading without comprehension “barking at print” (Healy, 1987).

Reading, Writing, and Literacy

The title of this book indicates that our primary concern is understanding how the brain of a child masters the processes of decoding print and eventually reads with fluency and comprehension. However, learning to read without stumbling, while essential, is not sufficient. Literacy takes a variety of forms from reading a listing in a phone book to researching and writing a dissertation. Regardless of the difference in cognitive requirements of these activities, they all require the reader to move beyond decoding to understanding and often require being able to express that understanding in written form. Literacy is much broader than just being able to decode print. It involves writing, spelling, and other creative and analytical acts. While it is not our primary emphasis, throughout this book we will address some of these broader literacy skills, particularly the development of writing and spelling skills.
REFLECTIVE QUESTIONS

1. Explain why reading in English is more difficult than reading in some other languages.

2. List and discuss at least two biological factors that can cause reading problems.

3. If you are reading this book as part of a study group, assign three people to make short presentations on the three environmental factors that impact reading ability, instructional, socioeconomic, and early language development.

4. Many children come to school without the prerequisite skills for reading. What are these skills and how might educators influence their acquisition?

5. Assume you are making a presentation to parents of kindergarten and/or first-grade students. How would you distinguish the difference between phonemic awareness and phonological awareness? How would explain the alphabetic principle?