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Emergent Literacy: Development from Prereaders to Readers



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שם הקודש: ניצחון

Learning to read is a key milestone for children living in a literate society. Reading skills provide a critical part of the foundation for children's academic success. Children who read well read more and, as a result, acquire more knowledge in numerous domains (Cunningham & Stanovich, 1998; Echols, West, Stanovich, & Zehr, 1996; Morrison, Smith, & Dow-Ehrensberger, 1995). Nagy and Anderson (1984, p. 328) estimated that the number of words read in a year by a middle-school child who is an avid reader might approach 10,000,000, compared to 100,000 for the least motivated middle-school reader. By virtue of the sheer volume read, substantial advantages in vocabulary and content knowledge accrue to children who are avid readers. In contrast, children who lag behind in their reading skills receive less practice in reading than do other children (Allington, 1984), miss opportunities to develop reading comprehension strategies (Brown, Palincsar, & Purcell, 1986), often encounter reading material that is too advanced for their skills (Allington, 1984), and acquire negative attitudes about reading itself (Oka & Paris, 1987). Such processes lead to what Stanovich (e.g., 1986) termed a "Matthew effect" (i.e., the rich get richer while the poor get poorer) such that those children with poor reading skills fall further and fur-

ther behind their more literate peers in reading as well as in other academic areas (Chall, Jacobs, & Baldwin, 1990).

More than one in three children experience significant difficulties in learning to read (Adams, 1990; Shaywitz, Escobar, Shaywitz, Fletcher, & Makuch, 1992), and there is strong continuity between the skills with which children enter school and their later academic performance. Those children who experience early difficulties in learning to read are unlikely to catch up to their peers (Baydar, Brooks-Gunn, & Furstenberg, 1993; Francis, Shaywitz, Stuebing, Shaywitz, & Fletcher, 1996; Stevenson & Newman, 1986; Torgesen, Wagner, Rashotte, Alexander, & Conroy, 1997; Tramontana, Hooper, & Selzer, 1988). For instance, Juel (1988) reported that the probability that children would remain poor readers at the end of the fourth grade if they were poor readers at the end of the first grade was .88. Children who enter school with limited reading-related skills are at high risk of qualifying for special education services. In fact, the majority of school-age children who are evaluated for special education services are referred because of unsatisfactory progress in reading (Lentz, 1988). Of those children who experience serious problems with reading, from 10 to 15% eventually drop out of high school and only 2% complete a 4-year

college program. Surveys of adolescents and young adults with criminal records show that about half have reading difficulties. Similarly, about half of youths with a history of substance abuse have reading problems (National Institute of Child Health and Human Development [NICHD], 2000a). (For additional discussion of developmental continuities see Scarborough, Chapter 8.)

Children from low-income families are at particular risk for reading difficulties (e.g., Dubow & Ippolito, 1994; Juel, Griffith, & Gough, 1986, Smith & Dixon, 1995) and are more likely to be slow in the development of oral language skills (e.g., Juel et al., 1986; Lonigan & Whitehurst, 1998; Whitehurst, 1996), letter knowledge, and phonological processing skills prior to school entry (Bowey, 1995; Lonigan, Burgess, Anthony, & Barker, 1998; MacLean, Bryant, & Bradley, 1987; Raz & Bryant, 1990). Socioeconomic-status-linked differences in phonological processing skills relate to later differences in word decoding skills (e.g., Raz & Bryant, 1990).

Based on a diverse body of research evidence, it now seems clear that learning to read is affected by the foundation skills of phonological processing, print awareness, and oral language. Children with more of these skills profit more from reading instruction, learn to read sooner, and read better than do children with less of these skills (Whitehurst & Lonigan, 1998). Many children, particularly those from low-income families, are not prepared for the reading instruction they will receive in first grade. They are likely to fail, with catastrophic results. It is not an exaggeration to say that the prevention of reading difficulties is a matter of survival for many children. We will examine recent research on paths of influence on learning to read that begin in the preschool period. If interventions designed to increase reading readiness and prevent reading difficulties are informed by this research, children should benefit. (For further discussion of the impact of home and community background factors, see Chapters 12–16 and 22.)

Emergent Literacy

Emergent literacy refers to the developmental precursors of formal reading that have

their origins early in the life of a child. This conceptualization departs from an older perspective on reading acquisition that sees the process of learning to read as beginning with formal school-based instruction in reading or with reading readiness skills taught in kindergarten, such as letter recognition. This reading readiness approach creates a boundary between the “real” reading that children are taught in educational settings and everything that comes before. In contrast, an emergent literacy perspective views literacy-related behaviors occurring in the preschool period as legitimate and important aspects of the developmental continuum of literacy. Current inquiry into emergent literacy represents a broad field with multiple perspectives and a wide range of research methodologies. It is complicated by changing conceptualizations of what constitutes literacy; for instance, recent years have seen the concept of literacy extended to any situation in which an individual negotiates the environment through the use of a symbolic system (e.g., maps, bus schedules, store coupons, and television advertisements). We restrict our focus to more conventional forms of literacy (i.e., the reading or writing of alphabetic texts). The majority of research on emergent literacy has been conducted with English-speaking children learning an alphabetic writing system; consequently, the extent to which these concepts of emergent literacy extend to children learning writing systems or languages other than English is not clear. Our approach in this chapter is to highlight those selected areas of emergent literacy that research has shown to be linked with later reading and that might be most relevant for early-intervention programs designed to affect children’s literacy skills. We focus here on how these emergent literacy abilities develop over time and how they affect each other.

Two Domains of Literacy

Whitehurst and Lonigan (1998) proposed that emergent and conventional literacy are derived from individuals’ ability to utilize information from two interdependent domains of information: *outside-in* and *inside-out*, as represented in Figure 2.1. The out-

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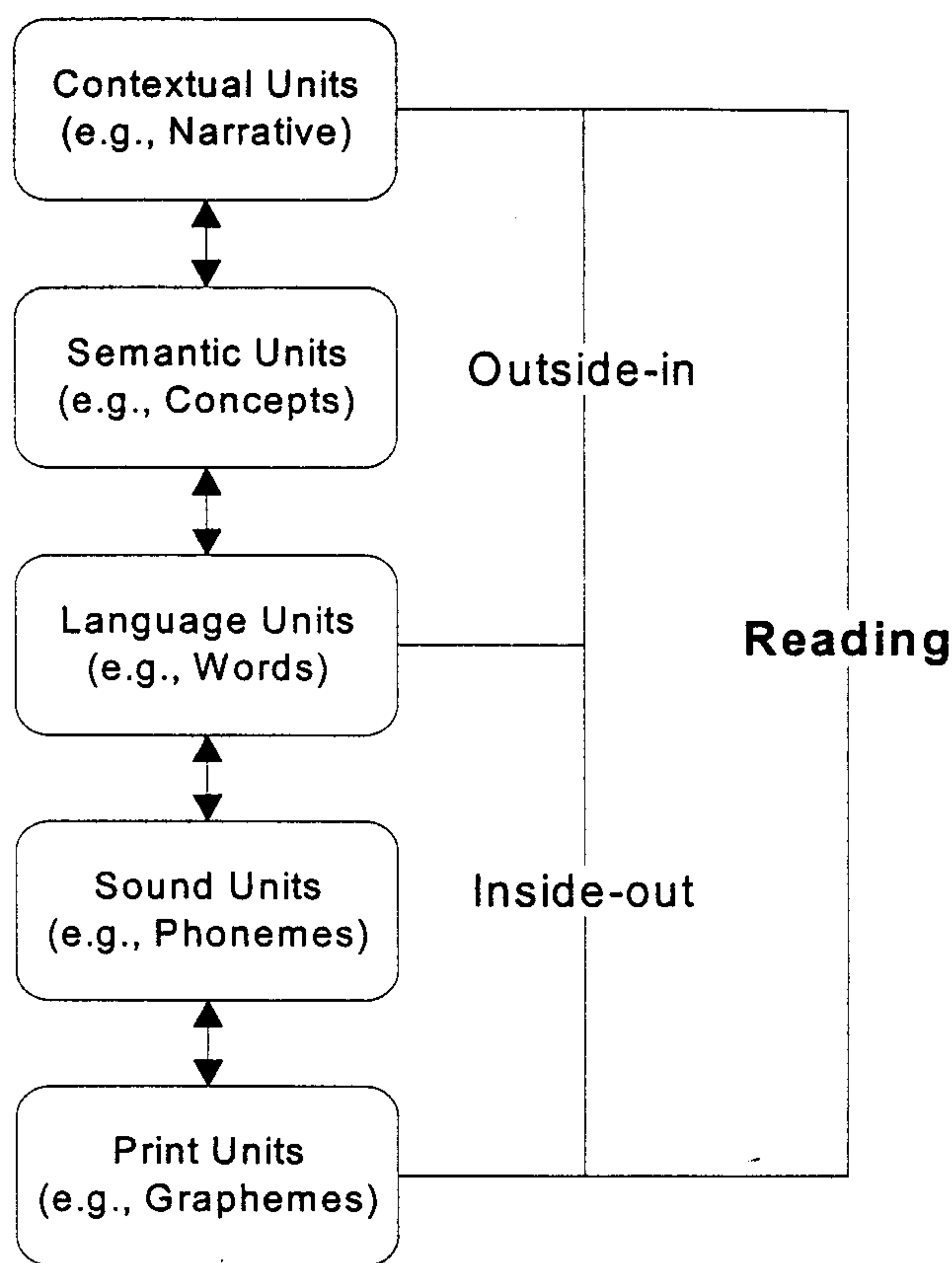


FIGURE 2.1. Fluent reading involves a number of component skills and processes. A reader must decode units of print into units of sound and units of sound into units of language. This is an inside-out process. However, being able to say a written word or series of written words is only a part of reading. The fluent reader must understand those auditory derivations, which involves placing them in the correct conceptual and contextual framework. This is an outside-in process. The bidirectional arrows in the figure illustrate that there is cross-talk between different components of reading. For example, the sentence context affects the phonological rendering of the italicized letters in these two phrases: "a *lead* balloon," "*lead* me there."

side-in units in the figure represent sources of information from outside the printed word that directly support children's understanding of the meaning of print (e.g., vocabulary, conceptual knowledge, and story schemas). The inside-out units represent sources of information within the printed word that support children's ability to translate print into sounds and sounds into print (e.g., phonemic awareness and letter knowledge). These sources of information are labeled *outside-in* and *inside-out*, rather than simply outside and inside to denote that in mature readers information from each domain penetrates into the processing of information from the other.

As an example of this distinction, imagine

a child trying to read the sentence, "She sent off to the very best seed house for five bushels of lupine seed" (Cooney, 1982, p. 21). The ability to decode the letters in this sentence into correct phonological representations (i.e., being able to say the sentence) depends on knowing letters, sounds, links between letters and sounds, punctuation, and sentence grammar, as well as cognitive processes, such as being able to remember and organize these elements into a sequence. These are inside-out processes, which are based on and keyed to sources of information that are available at the level of individual printed words and short sequences of words at the sentence level. However, a child could know how to process all the

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word-level print information in this sentence (i.e., be able to read the sentence aloud) and still not read it successfully. What does the sentence mean? Meaningful comprehension of all but the simplest of writing depends on knowledge that cannot be found in the word or sentence itself. Who is the "she" referred to in the earlier sentence? Why is she sending away for seed? Why does she need five bushels? What is lupine? In short, what is the narrative, conceptual, and semantic context in which this sentence is found, and how does the sentence make sense within that context? Answering these questions depends on outside-in information involving knowledge of the world, semantic knowledge, and knowledge of the written context in which this particular sentence occurred. Outside-in and inside-out sources of information are both essential to successful reading and are used simultaneously in readers who are reading well.

This distinction between outside-in and inside-out information sources is related to but different from a distinction in the psychological literature between top-down and bottom-up processing. "Top-down" and "bottom-up" are terms taken from the literature on perception. They refer to whether an individual perceives a stimulus (e.g., recognizing a person's face) by noticing separate defining features of the stimulus and assembling them into a recognizable pattern (bottom-up), or perceives a stimulus by use of the context and what is already known about the situation (top-down). Outside-in sources of information for reading can support top-down processing, while inside-out sources of information can support bottom-up processing; thus in this way the distinctions are superficially similar. However, top-down and bottom-up are alternative routes to the same destination. Thus we can recognize the person who has just entered the room as "Joe" because he is the person we are all waiting for (top-down), or because he is the person with the bushy eyebrows and red hair (bottom-up). However, a successful reader cannot use either outside-in or inside-out sources of information to read: Both are essential. Further, inside-out and outside-in refer to sources of information that have to be processed rather than to specific psychological or neurological process-

ing mechanisms, as in the case for bottom-up and top-down. Because outside-in and inside-out are sources of information to be processed, it is possible for top-down and bottom-up processing to occur within each of these domains of information. Thus, within the inside-out domain of information, a reader's ability to sound out or decode a particular printed word will depend on the bottom-up process of translating letters to their corresponding phonemes as well as on top-down, contextual processing (e.g., a competent reader will process the "e" in "read" differently than the "e" in "red" because of the effect of the surrounding context of letters). Likewise, within the outside-in domain of information, a reader's ability to understand a newspaper story about Bill Gates buying *The New York Times* will depend on a bottom-up assembly of information in the story as well as on top-down influences from cultural knowledge about Bill Gates.

In summary, the inside-out domain comprises the sources of information about which a reader must develop skills and knowledge that allow a translation of print into phonological representations, and vice versa. The outside-in domain comprises the sources of information to which the reader must apply skills and knowledge that enable understanding of phonological representations. Inexpensive software for personal computers is readily available that will render print into speech (i.e., that can process inside-out information). However, a computer that can understand what it reads is still to be found only in science fiction. Although understanding of print is the goal and requires complex human cognitive abilities and experience, neither a computer nor a human can understand print that it cannot decode. Thus learning to decode (i.e., to smoothly, effectively, and effortlessly process inside-out information in print) is a critical step in learning to read for meaning.

Components of Emergent Literacy

Elsewhere we have reviewed research on emergent literacy with respect to each of the elements in Figure 2.1 (Whitehurst & Lonigan, 1998). Here we focus on two inside-out elements (phonological processing and

print awareness (oral language) for a linguistically strong child. The effects of print awareness, we predict, will be particularly tested in the interrelationships between emergent literacy and

Phonological Awareness

Within the domain of phonological awareness, research has shown that phonological awareness is a key component of reading development (Adams, 1987). Phonological awareness includes the ability to identify, or manipulate, the individual sounds (phonemes) that make up words. Research has shown that clusters of phonological awareness skills, including phoneme deletion, and phoneme substitution, are important for reading development (Torgesen, 1986).

1. *Phoneme awareness* is the ability to identify the individual sounds (phonemes) that make up words. For example, a child with phoneme awareness can count the number of phonemes in the word "donut," or identify the sounds /d/ and /n/. It is important for children to develop phonological awareness skills. It is a method that is used to identify the relationship between letters and sounds.

The development of young children's ability to identify the individual sounds (phonemes) that make up words and syllables is a key component of reading development (onset (i.e., the beginning of a syllable) and the dominant cluster of phonemes in a syllable) and the relationship between vowel and consonant clusters in a syllable.

print awareness) and one outside-in element (oral language) about which the evidence for a link to conventional literacy is strongest. After reviewing evidence on the effects of phonological processing, print awareness, and oral language on learning to read, we present a conceptual and empirically tested model of the developmental interrelationships among these aspects of emergent literacy.

Phonological Processing Skills

Within the past two decades, a strong consensus has emerged concerning the role of phonological processing in the acquisition of reading and spelling in alphabetic languages (Adams, 1990; Wagner & Torgesen, 1987). Phonological processing refers to activities that require sensitivity to, manipulation of, or use of the sounds in words. Prior research has identified three interrelated clusters of phonological processing abilities: phonological sensitivity, phonological naming, and phonological memory (Wagner & Torgesen, 1987).

1. *Phonological sensitivity* refers to the ability to detect and manipulate the sound structure of oral language. Phonological sensitivity might be revealed by a child's ability to identify words that rhyme, blend spoken syllables or phonemes together to form a word, delete syllables or phonemes from spoken words to form a new word, or count the number of phonemes in a spoken word. For example, assessing sensitivity to phonemes might involve asking the child to count the number of phonemes in the word "donut," or to say what word results when the sounds /b/ . . . /a/ . . . /t/ are put together. It is important to understand that phonological sensitivity is an oral language skill that can develop without any exposure to print or letters. It is not phonics, which is a teaching method that emphasizes the relationship between letters and corresponding sounds.

The developing phonological sensitivity of young children progresses from sensitivity to large and concrete units of sound (i.e., words and syllables) to subsyllabic units of onset (i.e., the initial consonant or consonant cluster in a syllable) and rime (i.e., the vowel and final consonant or consonant cluster in a syllable) to small and abstract

units of sound (i.e., phonemes) (Adams, 1990; Anthony et al., 2000; Fox & Routh, 1975; Lonigan, Burgess, & Anthony, 2000; Lonigan et al., 1998). Phonological sensitivity promotes the development of decoding skills because graphemes in written language correspond to speech sounds at the level of phonemes. If children cannot perceive the individual sounds in spoken words, they will have difficulty identifying the correspondence between print and the language it represents.

2. *Phonological memory* refers to short-term memory for sound-based information (Baddeley, 1986) and is typically measured by immediate recall of verbally presented material. For example, phonological memory might be assessed by having a child repeat nonwords of increasing length (e.g., "weem" and "nokysims"), repeat increasingly longer sentences (e.g., "The big dog" and "The cat in the hat stood on the chair."), or repeat lists of digits that increase in length (e.g., "4 . . . 3" and "5 . . . 2 . . . 8 . . . 4"). Efficient phonological memory enables children to maintain an accurate representation of the phonemes associated with the letters of a word while decoding and, therefore, devote more cognitive resources to decoding and comprehension processes.

3. *Phonological naming* refers to the efficiency of retrieval of phonological information from permanent memory. Two measures of phonological naming have been used, isolated naming and serial naming. In isolated naming, the child is presented with a picture of a single object and the time to begin a pronunciation is measured. Performance on serial-naming tasks for older children is typically measured as the time it takes for all individual elements in an array of letters, digits, or colors to be named. In younger children, performance on a serial-naming task might be measured by asking the child to name a sequence of pictures of objects (e.g., rat, man, house, tree, and snake) as fast as he or she can. Efficiency in phonological access might influence the ease with which a child can retrieve the phonological information associated with letters, word segments, and whole words and increase the likelihood that he or she can use phonological information in decoding (Bowers & Wolf, 1993; Wolf, 1991).

These three phonological processes are strongly related to subsequent decoding abilities (e.g., the ability to sound out words), and, in the absence of intervention, individual differences in these processes are highly stable from the late preschool period forward (Burgess & Lonigan, 1998; Lonigan et al., in press; Torgesen & Burgess, 1998; Wagner, Torgesen, & Rashotte, 1994; Wagner, Torgesen, Laughon, Simmons, & Rashotte, 1993; Wagner et al., 1997). For example, Wagner et al. (1994) reported that year-to-year stability coefficients for phonological sensitivity ranged from .83 (from kindergarten to first grade) to .95 (from second grade to third grade and from third grade to fourth grade).

Poor phonological processing skills are the hallmark of poor readers. There is a core phonological deficit (i.e., sensitivity or access) in nearly all poor readers, and there are deficits in other reading-related skills (e.g., vocabulary) in some poor readers depending on the degree to which their level of reading is discrepant from their level of general cognitive and academic functioning (Stanovich, 1988; Stanovich & Siegel, 1994). In other words, a poor reader may exhibit low levels of phonological processing skills compared to his or her same-age peers but have oral-language skills and general cognitive abilities that are consistent with age expectations (i.e., the condition typically referred to as dyslexia). In contrast, a poor reader may exhibit low levels of phonological processing skills, oral language, and general cognitive abilities compared to his or her same-age peers (i.e., a condition sometimes referred to as garden-variety poor reading). Both types of poor readers have deficient phonological processing. Children who have what is sometimes called a double deficit (i.e., poor performance on both phonological sensitivity and phonological naming tasks relative to same-age peers) tend to be at the very bottom of the distribution of reading ability (Bowers, 1995; Bowers & Wolf, 1993; McBride-Chang & Manis, 1996).

The majority of work concerning pre-readers' phonological processing skills has examined phonological sensitivity. Individual differences in preschool and kindergarten children's phonological sensitivity are related to early reading acquisition (e.g.,

Bradley & Bryant, 1983, 1985; Bryant, MacLean, Bradley, & Crossland, 1990; Lonigan et al., in press; Stanovich, Cunningham, & Cramer, 1984). Children who are better at detecting rhymes, syllables, or phonemes are quicker to learn to read, and this relation is present even after variability due to factors such as IQ, vocabulary, memory, and social class are removed statistically (Bryant et al., 1990; MacLean et al., 1987; Raz & Bryant, 1990; Wagner & Torgesen, 1987; Wagner et al., 1994, 1997).

Experimental demonstrations that training children in phonological sensitivity positively affects reading support a causal relation between phonological sensitivity and early reading skills (e.g., Bradley & Bryant, 1985; Brady, Fowler, Stone, & Winbury, 1994; Byrne & Fielding-Barnsley, 1991a, 1993). For example, Byrne and Fielding-Barnsley (1991a) taught preschool children to identify a limited number of phonemes in the initial and final positions of words. These children scored higher on measures of phonological sensitivity than did a control group, and their ability to decode words was also higher.

Print Principles

Knowledge of the alphabet at school entry is one of the single best predictors of eventual reading achievement (Adams, 1990; Stevenson & Newman, 1986). In alphabetic writing systems, decoding text involves the translation of units of print (graphemes) to units of sound (phonemes), and writing involves translating units of sound into units of print. At the most basic level, this task requires the ability to distinguish letters. A beginning reader who cannot recognize and distinguish the individual letters of the alphabet will have difficulty learning the sounds those letters represent (Bond & Dykstra, 1967; Chall, 1967; Mason, 1980). In some cases, the task of learning letter-sound correspondence is facilitated by letter names that are the same as one of the phonemes that the letter represents. For example, the name of the letter "e" is the sound made by that letter in words such as "be." In other cases letter names are different from the phonemes those letters map onto. For example, the word "not" would be pronounced as "en-ot" if the name of

the letter "n" letter.

The potential for letter-name to have led to development of materials to avoid teaching children to teach direct letter names to make different letter shape "a" and short "a" date has even teaching the harmful to children letter names between letters. Studies of the relation between reading and phonological processing found that children with stronger phonological processing skills than is letter names (Burgess & Lonigan, 1994). Letter names information about (e.g., the /t/ in beginning reading) relation in reading (Burgess & Lonigan, 1985; Read,

In addition to text decoding, letter names play an influential role in the development of phonological processing and after the instruction. High letter names are associated with letter names and many studies (Burgess & Lonigan, 1994; Johnson & Lonigan, 1996; Stahl & Lonigan, 1996). Wagner (1996) found that the results of the study explicitly tested the relation between letter names and reading development. Differences in letter names are related to measures of reading ability and 2 years later (Lonigan, 1996). Children's letter names are a predictor of growth in reading across one year. Despite the importance of letter names, knowledge of

the letter "n" was the sound linked to that letter.

The potentially confusing nature of letter-name to letter-sound correspondence has led developers of some curriculum materials to avoid letter names entirely when teaching children (e.g., Lindamood, 1995; McGuinness, 1997), preferring instead to teach directly that different letter shapes make different sounds; for example, the letter shape "a" makes two sounds (long "a" and short "a"). However, no research to date has evaluated the degree to which teaching the names of letters is helpful or harmful to children compared to leaving out letter names and teaching the connection between letter shapes and sounds directly. Studies of the early development of decoding and phonological sensitivity have generally found that letter-name knowledge is a stronger predictor of growth in these skills than is letter-sound knowledge (e.g., Burgess & Lonigan, 1998; Wagner et al., 1994). Letter names provide relevant information about the sounds they represent (e.g., the /t/ in "tee," /k/ in "kay"), and beginning readers appear to use this information in reading and writing (Ehri & Wilce, 1985; Read, 1971; Treiman, 1993).

In addition to its direct role in facilitating text decoding, letter knowledge appears to play an influential role in the development of phonological sensitivity, both prior to and after the initiation of formal reading instruction. Higher levels of letter knowledge are associated with children's abilities to detect and manipulate phonemes (e.g., Bowey, 1994; Johnston, Anderson, & Holligan, 1996; Stahl & Murray, 1994) but not rhyme and syllables (Naslund & Schneider, 1996). Wagner et al. (1994, 1997) reported the results of a longitudinal study that explicitly tested the influence of letter knowledge on subsequent phonological sensitivity development. They found that individual differences in kindergarten and first-grade letter knowledge were significantly related to measures of phonological sensitivity 1 and 2 years later. Likewise, Burgess and Lonigan (1998) found that preschool children's letter knowledge was a unique predictor of growth in phonological sensitivity across one year.

Despite these strong links between letter knowledge and later reading, interventions

that teach children letter names alone do not seem to produce large effects on reading acquisition (Adams, 1990). Interventions designed to promote emergent inside-out skills are most powerful when training in both phonological sensitivity and letter knowledge is included in the intervention (e.g., Bradley & Bryant, 1985). For example, combining training in phoneme identity by classifying words based on their initial sounds (e.g., bat, ball, beach, bell, and bill all start with the /b/ sound) with training to identify the initial letter of words (i.e., words that start with the /b/ sound such as bat, ball, and beach, begin with the letter "b") appears to produce stronger effects on subsequent reading skills than the sound categorization training alone.

Emergent Writing

Another route to print awareness and letter knowledge is through writing and invented spelling. Behaviors such as pretending to write and learning to write one's name are examples of emergent writing. Many adults have had the experience of seeing a young child scribble some indecipherable marks on paper and then ask an adult to read what it says. The child is indicating that he or she knows print has meaning without yet knowing how to write. There have been a number of descriptive studies of children's emergent writing (e.g., Ferreiro & Teberosky, 1982; Harste, Woodward, & Burke, 1984; Sulzby, 1986). Most of these studies converge on a common developmental pattern of children's emergent writing. It appears that very young children treat writing in a pictographic sense that includes using drawing as writing or using scribble-like markings with meaning only to the child. Later, children begin to use different letters, numbers, and letter-like forms to represent the different things being written about. In this phase, children may reorder relatively few symbols to stand for the different words. Often in this phase, characteristics of the thing written are encoded into the word (e.g., a bear is bigger than a duck, therefore, the word "bear" has to be bigger than the word "duck"). For many children in the late preschool period, letters come to stand for the different syllables in words, and from this stage children finally begin to

use letters to represent the individual sounds (e.g., phonemes) in words.

When prereaders use letters to represent individual sounds, they often do so in an idiosyncratic way (e.g., representing only the first and last sounds of a word as in the spelling "BK" for the word "bike"). This type of writing has been termed "invented spelling," which consists of writing words following a more or less phonological, rather than orthographic, strategy. Invented spelling appears to be a vehicle through which many children grapple with and begin to understand the alphabetic principle (that letters represent sounds) (Clarke, 1988; Ehri, 1988). For example, Torgeson and Davis (1996) found that a pretest measure of kindergarten children's ability to engage in invented spelling was the strongest and most consistent predictor of their progress in a phonological training curriculum. Clarke (1988) found that first-graders who were encouraged to invent spellings of words for which they did not know the correct spelling showed more progress in spelling and decoding than children who were not encouraged to invent spellings. The longitudinal research of Whitehurst and colleagues, summarized subsequently in Figure 2.2, indicates that the relatively advanced writing skill of invented spelling has developmental origins in acts such as drawing pictures of objects and writing one's name. Because of the demonstrated effects of emergent writing on children's acquisition of the alphabetic knowledge, and because drawing and scribbling are expressive acts that are well suited to the proclivities of preschoolers, activities that encourage writing at the preschool level are promising avenues for interventions to enhance emergent literacy.

Oral Language Skills

Reading is a process of translating visual codes into meaningful language. In the earliest stages, reading in an alphabetic writing system involves decoding letters into corresponding sounds and linking those sounds to single words. In more advanced stages, reading involves complex synthesis of linguistic meaning from the inside-out and outside-in domains of information. The developmental links between oral language skills and read-

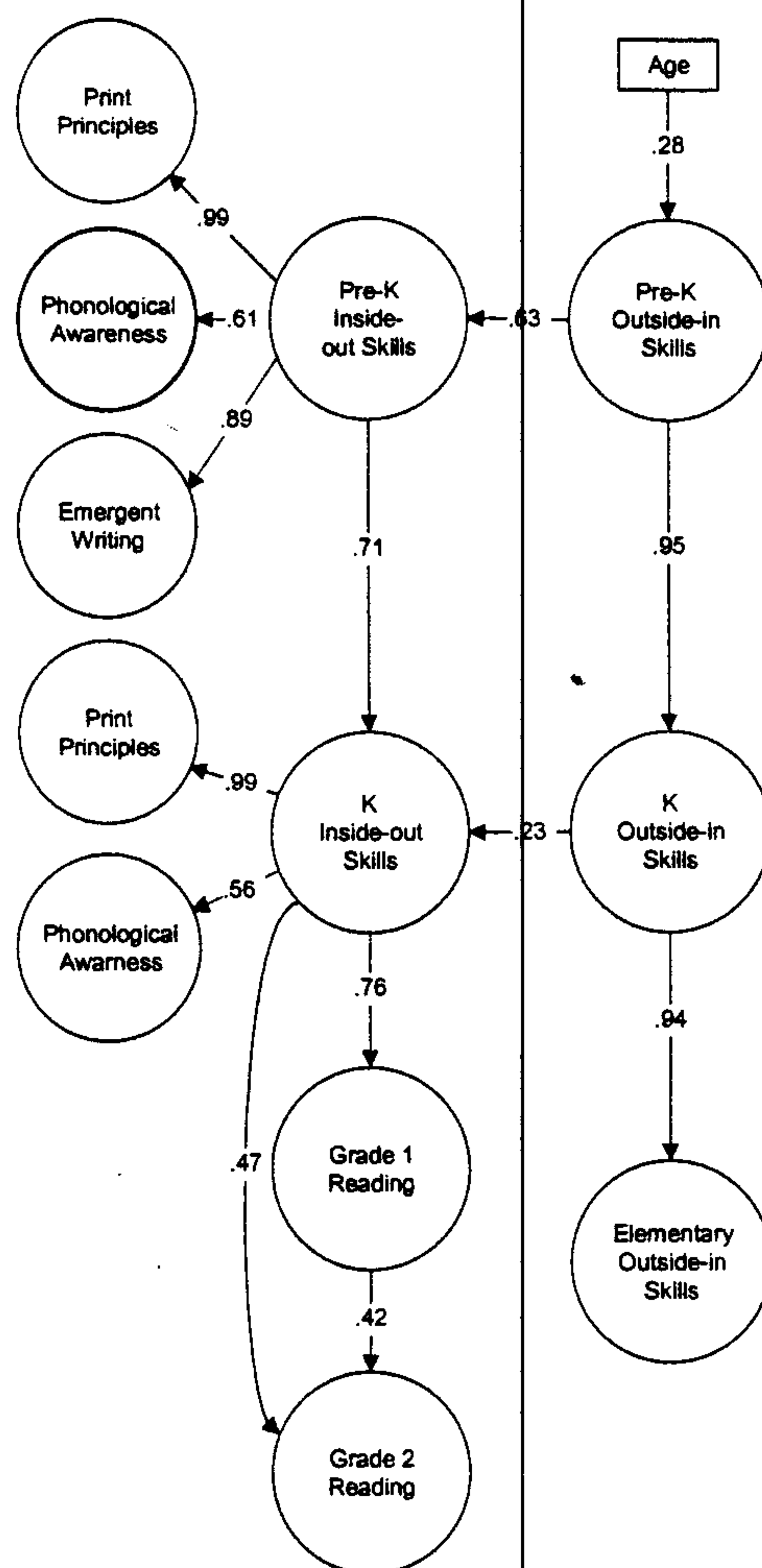


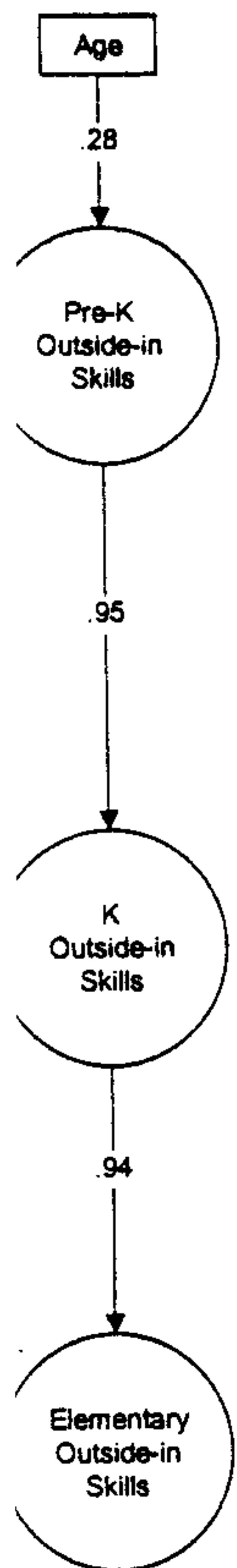
FIGURE 2.2. A structural model of the development of inside-out and outside-in skills from pre-K through second grade. A sample of 367 children was followed annually. The CFI fit index for the model is .92.

ing have generally been ignored in the literature, from which it is possible to form the impression that vocabulary and other oral linguistic skills are positively and causally related to reading at all levels of a child's development of reading. Thus we have the National Research Council's conclusion that the majority of reading problems could be prevented by, among other things, increasing children's oral language skills (Snow, Burns, & Griffin, 1998), and the conclusion of the National Reading Panel that vocabulary is critically important in oral reading instruction (NICHD, 2000b).

Consistent number of studies show positive relationships between oral language skills and reading (e.g., Bishop, Marshall, Skuse, & Stothard, 1989; Share, 1984). In other words, a larger vocabulary is associated with higher scores. However, the relationship between vocabulary and reading may reflect the effect of third variables such as child's home literacy and reading environment, indicating that oral language and reading are child's stage well as literacy start the reading school children preschoolers consider children who code in early readers).

Among other things, fifth-graders) reading and language and bidirectional semantic knowledge comprehend what Dodd, 1994; 1982; Snow, Goodman, 1994; Tunmer, Herrington, Scanlon, relationship flow children who read develop large concepts and Stanovich, 1989; West, 1989). In older children, edge, and knowledge comprehension.

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Consistent with these conclusions, a number of studies demonstrate positive correlations between individual differences in oral language skills and later differences in reading (e.g., Bishop & Adams, 1990; Butler, Marsh, Sheppard, & Sheppard, 1985; Pikulski & Tobin, 1989; Scarborough, 1989; Share, Jorm, MacLean, & Mathews, 1984). In other words, children who have larger vocabularies and greater understanding of spoken language have higher reading scores. However, simple correlations between vocabulary size and reading scores may reflect nothing more than the influence of third variables, such as the quality of a child's home environment, on both vocabulary and reading. We review recent research indicating that the connection between oral language and reading is conditional on the child's stage of development in language, as well as literacy, and is causally complex. We start the review with older elementary school children, (readers) then move to preschoolers (prereaders), and finally consider children who are just learning to decode in early elementary school (beginning readers).

Among older readers (e.g., fourth- and fifth-graders) the relationship between reading and language comprehension is direct and bidirectional. Thus children with more semantic knowledge are better able to comprehend what they are reading (Gillon & Dodd, 1994; Mason, 1992; Share & Silva, 1982; Snow, Barnes, Chandler, Hemphill, & Goodman, 1991; Tunmer & Hoover, 1992; Tunmer, Herriman, & Nesdale, 1988; Velutino, Scanlon, & Tanzman, 1991). The relationship flows the other way as well: Children who read more frequently and fluently develop larger vocabularies and stores of concepts and facts (Cunningham & Stanovich, 1991, 1998; Stanovich & West, 1989; West, Stanovich, & Mitchell, 1993). In older children, reading generates knowledge, and knowledge supports reading comprehension.

Skipping from older readers to the other end of the developmental range, prereaders, one of the most interesting findings of recent research on emergent literacy is the relationship between vocabulary size and phonological sensitivity. Children with larger vocabularies have more developed phonological sensitivity (Wagner et al.,

1993, 1997). This relationship begins early in the preschool period (Burgess & Lonigan, 1998; Chaney, 1992; Lonigan et al., 1998, 2000).

Vocabulary growth appears to be causal in children's movement from global to segmented representations for words (e.g., "homework" to "home" - "work"). As children learn more words, it becomes more efficient to remember words in terms of their constituent parts rather than as wholes. Children who have small vocabularies are limited in their phonological sensitivity because they have not yet been forced by the sheer size of the vocabulary to move from global to segmented representations of words: Vocabulary development sets the stage for the emergence of phonological sensitivity (Fowler, 1991; Metsala & Walley, 1998, see Goswami, Chapter 9, for more on this topic).

A Structural Model of the Development of Emergent Literacy

The two relationships we have described, between oral vocabulary size and phonological awareness in prereaders and between oral vocabulary and comprehension in older readers, are captured in research by Whitehurst and colleagues that we described subsequently (Whitehurst & Fischel, 2000; Whitehurst & Storch, in press). This research also addresses the relationship between oral language and reading among beginning readers, demonstrating that the relationship is indirect (i.e., mediated by phonological sensitivity and other inside-out skills acquired in the preschool period). This has clear implications for the timing and focus of interventions to support emergent literacy.

The project followed several hundred children from low-income families from their entry into Head Start, when they had just turned 4, to their exit from fifth grade as 10-year-olds. Measures of outside-in and inside-out skills were collected at Head Start exit and at kindergarten exit. Measures of reading ability and oral language ability were collected annually at the end of first through fifth grades. Results through grade 2 are summarized here.

We used structural equation modeling (SEM) to examine causal possibilities within

the data from the assessments described previously. Although SEM is at the core of modern statistical approaches to correlational data and has become relatively accessible to researchers, it is still sufficiently new that a brief primer may be useful (Byrne, 1994). SEM begins with what is a conceptual rather than a statistical component: causal modeling. A causal model is an hypothesis about the field of variables that affect one or more dependent variables of interest, presented formally as a path diagram. The diagram in Figure 2.2 represents causal hypotheses with respect to the links between emergent literacy and literacy skills for the children from low-income backgrounds. The second step in SEM is to develop a measurement model that corresponds to the constructs specified in the causal model. Whenever possible, multiple indicators of a given ability or construct are used, thereby introducing a distinction between latent variables and observed variables. When a particular construct, such as reading ability, is measured with multiple indicators, it is represented in path diagrams as a circle or an oval (i.e., as a latent variable, e.g., Grade 2 Reading in Figure 2.2). In contrast, when a construct is measured with only one test or instrument, it is represented in path diagrams as a square or rectangle (i.e., as a measured variable, e.g., Age in Figure 2.2). Relations between variables in SEM, whether the variables are latent or measured, are represented by path diagrams, which are collections of variables connected by lines and arrows. If variables are connected by a line with a single arrowhead, the variable with the arrowhead pointing into it is being modeled as determined by the variable with the line leading out of it (e.g., Grade 2 Reading in Figure 2.2 is modeled as determined in part by Grade 1 Reading). The third step in SEM is to assess the model against the data that have been collected. The statistical assessment of a model generates one or more measures of the degree of fit between the model and the matrix of correlations between the variables to which the model has been applied. The Bentler comparative fit index (CFI) is a frequently used measure of fit (Bentler, 1995). The CFI ranges from 0 to 1, with values around .9 or above traditionally viewed as indicating relatively close fit

between a model and the underlying data. Along with a measure of fit come weight estimates for each of the paths in the model. These are related to standardized betas in multiple regression or correlation coefficients in simple correlation. They provide a standardized estimate of the strength of influence of a given path. However, unlike simple regression or correlation coefficients, each path weight is conditional on and takes into account all the other variables in the model. Thus a high simple correlation between two variables (e.g., oral language scores in pre-K and reading scores in second grade) might diminish or be shown to be mediated or moderated by other variables in full structural model.

Figure 2.2 represents the structural equation model applied to the data from Head Start children described earlier. The focus in this model is the measurement and development of inside-out and outside-in skills, not in the variables in the child's environment, such as literacy practices in the home, that might influence the development of those skills. A consideration of environmental and background variables can be handled easily once the skill sequence is well mapped. We have reported such data elsewhere (e.g., Whitehurst & Fischel, 2000). The CFI index for the model in Figure 2.2 is .92. Thus the fit between the model and the data is good, particularly given the number of variables and time span involved.

The model is arranged in temporal order from the top to the bottom of the figure. The temporal ordering of the variables in the model corresponds both to when the data were collected and when the variables in the model are assumed to be operating. The inside-out variable at pre-K (Head Start) is composed of three latent variables, Print Principles, Phonological Awareness, and Emergent Writing. These are the three principle domains of inside-out abilities previously described in this chapter. These three latent variables are defined by measured variables that are subtests of the Developing Skills Checklist (CTB/McGraw-Hill, 1990). Emergent Writing is dropped from the model at K (kindergarten), not because it is unimportant but because the measures employed (e.g., the child's ability to write his or her name) have generally been mastered by children in our sample by the end of kindergarten. The out-

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derlying data. The weight estimates in the model. The standardized betas in the correlation coefficients they provide a strength of influence. However, unlike the coefficients, the correlation on and other variables in the correlation matrix. The oral language scores in second grade are shown to be related to other variables in

structural equations from Head Start. The focus is on the development of skills, not the environment, the home, that the measurement of those environmental and other variables is handled easily and well mapped. We have elsewhere (e.g., Crone & Whitehurst, 1999). The CFI index is .92. Thus the data is good, and the number of variables

temporal order of the figure. The variables in the model when the data variables in the model are entering. The inside-out (Head Start) is a set of variables, Print awareness, and the three principles previously discussed. These three latent measured variables are developing Skills (Crone & Whitehurst, 1990). Emergent literacy in the model at kindergarten is unimportant and is not employed (e.g., the child's name) have been used for children in our sample. The out-

side-in variable at pre-K and K represents separate measures of receptive vocabulary (the Peabody Picture Vocabulary Test—Revised; Dunn & Dunn, 1981) and expressive vocabulary (the Expressive One-Word Picture Vocabulary Test; Gardner, 1990) taken each year. The outside-in variable in elementary school represents measures of receptive vocabulary (the Peabody Picture Vocabulary Test—Revised) taken separately in grade 1 and Grade 2. Grade 1 Reading is a latent variable defined in by scores on three tests of reading, the Stanford Achievement Test Word Reading subscale (Psychological Corporation, 1989), the Wide Range Achievement Test Word Reading subscale (Jastak & Wilkinson, 1984), and the Woodcock Word Attack subscale (Woodcock, 1987). Grade 2 Reading is similar, with the Stanford Achievement Test Comprehension subscale substituted for the Wide Range Achievement Test Word Reading subscale. Age is entered in the model because raw scores or their equivalents were used for all measures in Figure 2.2 rather than age-standardized scores. It makes sense to use raw scores because children within a particular grade are generally held to the same standards whether they are younger or older members of their class, and all children were tested at the end of each school year. Further, we are interested in how skills develop over time, which is difficult to detect when children's scores are adjusted for their ages. However, chronological age still affects outcomes, particularly for outside-in language skills, as shown in Figure 2.2 and in previous research on this sample (Crone & Whitehurst, 1999).

Note three findings that are illustrated in Figure 2.2:

1. There is striking continuity within the outside-in and inside-out dimensions of emergent literacy, with betas (correlations) in the .90s for the outside-in skills, and a beta of .71 between inside-out skills in pre-K and the same skills in kindergarten. Thus individual differences among children on these skills are set very early (by age 4) and children's degree of skill in these domains relative to other children in the sample is quite stable thereafter.

2. Inside-out emergent literacy skills in kindergarten predict reading in second

grade directly and with greater strength (beta = .47) than reading in first grade predicts reading in second grade (beta = .42). Thus emergent literacy skills in kindergarten such as phonological awareness and letter recognition are as important or more important than the child's actual reading success in first grade in predicting later reading outcomes.

3. The relationship between inside-out and outside-in skills is very strong in the pre-K period (beta = .63), but this relationship becomes weak in kindergarten (beta = .23) and is nonsignificant in first and second grade. Thus during early elementary school when children are learning to read, their knowledge of language and concepts (outside-in skills) and their reading and prereading skills (inside-out skills) are modular; that is, having a larger vocabulary in first grade does not directly help a child learn to read. The influence of vocabulary size is indirect and mediated by the child's earlier acquisition of inside-out skills.

The most important practical issue that can be addressed with the data analyses that are reflected in Figure 2.2 is the origins of differences in how well children from low-income families learn to read. The picture that emerges is remarkably clear and consistent with the conceptual distinction between inside-out and outside-in skills presented previously: Reading success through the end of second grade is directly and strongly dependent on the inside-out skills that children bring to the task of reading from the preschool and kindergarten period. Note that 58% of the variance in reading outcomes in grade 1 can be accounted for by the child's inside-out skills at the end of kindergarten (derived by squaring the path weight). In turn, 50% of the variance in inside-out skills in kindergarten can be accounted for by inside-out skills from the preschool period. The stability in language trajectories is even higher, with 90% of the variance in outside-in skills in kindergarten accounted for by outside-in skills at the end of pre-K, and 88% of the variance in outside-in scores in grades one and two accounted for by outside-in skills at the end of kindergarten. Children who start school behind in these areas are likely to stay behind.

The model we have found to fit the data

from our sample through the end of second grade is surprising in that it suggests that inside-out and outside-in processes are connected in the preschool period but become substantially separate and modular in kindergarten, first, and second grade. Thus interventions that hope to impact outside-in skills such as vocabulary and knowledge of narrative structure need to occur early in the preschool period if they are to have later effects during the decoding stages of learning to read.

Environments That Encourage the Development of Emergent Literacy

Given the findings in Figure 2.2, what do we know of interventions and environments that support the growth of emergent literacy? The prototypical and iconic aspect of home literacy, shared book reading, provides a potentially rich source of information and opportunity for children to learn language in a developmentally sensitive context (e.g., DeLoache & DeMendoza, 1987; Ninio, 1980; Pellegrini, Brody, & Sigel, 1985; Sénéchal, Cornell, & Broda, 1995; Wheeler, 1983). For instance, Wells (1985) found that approximately 5% of the daily speech of 24-month-old children occurred in the context of storytime, and Ninio and Bruner (1978) reported that the most frequent context for maternal labeling of objects was during shared reading. Shared reading and print exposure foster vocabulary development in preschool children (e.g., Cornell, Sénéchal, & Broda, 1988; Elley, 1989; Jenkins, Stein, & Wyszocki, 1984; Sénéchal & Cornell, 1993; Sénéchal, LeFevre, Hudson, & Lawson, 1996; Sénéchal, Thomas, & Monker, 1995), and print exposure has substantial effects on the development of reading skills at older ages when children are already reading (e.g., Allen, Cipielewski, & Stanovich, 1992; Anderson & Freebody, 1981; Cunningham & Stanovich, 1991, 1998; Echols et al., 1996; Nagy, Anderson, & Herman, 1987).

Sénéchal et al. (1996) reported that other aspects of the home literacy environment (e.g., number of books in the home, library visits, and parents' own print exposure) were related to children's vocabulary skills;

however, only the frequency of library visits was related to children's vocabulary after controlling for the effects of children's print exposure. Payne, Whitehurst, and Angell (1994) found that adult literacy activities in low-income households (e.g., the amount of time a parent spends reading for pleasure) were not significantly related to children's oral language, which was best predicted by activities that directly involved the child (i.e., frequency of shared reading, number of children's books in the home, frequency of library visits with child). Other aspects of adult-child verbal interactions have also been implicated in the acquisition of some emergent literacy skills. For example, Dickinson and Tabors (1991; see also Beales, DeTemple, & Dickinson, 1994) reported that features of conversations among parents and children (during meals and other conversational interactions (e.g., the proportion of narrative and explanatory talk)) contributed to the development of children's decontextualized language skills.

Most existing studies do not support a direct link between shared reading and growth in phonological skills (Lonigan, Dyer, & Anthony, 1996; Raz & Bryant, 1990; Whitehurst, 1996). For example, Lonigan et al. (1996) found that growth in preschool phonological sensitivity was related to parental involvement in literacy activities in the home (i.e., frequency of parents' reading for pleasure and children observing parents reading), but growth in phonological sensitivity was not associated with shared reading frequency. Similarly, Sénéchal, LeFevre, Thomas, and Daley (1998) reported that kindergarten and first-grade children's written language knowledge (i.e., print concepts, letter knowledge, invented spelling, and word identification) was associated with parental attempts to teach their children about print but not exposure to storybooks. In contrast, children's oral language skills were associated with storybook exposure but not parents' attempts to teach print. Some evidence suggests that exposure to alphabet books may increase children's letter knowledge and phonological processing skills (Baker, Fernandez-Fain, Scher, & Williams, 1998; Murray, Stahl, & Ivey, 1996). Some studies find a relation between experiences with word games in the home and the development of phonological pro-

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Emergent Literacy Interventions

A number of interventions have been developed to enhance children's oral language skills through shared reading. The most widely researched and validated of these interventions is called dialogic reading (Whitehurst & Lonigan, 1998). Dialogic reading involves several changes in the way adults typically read books to children. Central to these changes is a shift in roles. During typical shared reading, the adult reads and the child listens, but in dialogic reading the child learns to become the storyteller. The adult assumes the role of an active listener, asking questions, adding information, and prompting the child to increase the sophistication of descriptions of the material in the picture book. A child's responses to the book are encouraged through praise and repetition, and more sophisticated responses are encouraged by expansions of the child's utterances and by more challenging questions from the adult reading partner. For 2- and 3-year-olds, questions from adults focus on individual pages in a book, asking the child to describe objects, actions, and events on the page (e.g., "What is this? What color is the duck? What is the duck doing?"). For 4- and 5-year-olds, questions increasingly focus on the narrative as a whole or on relations between the book and the child's life (e.g., "Have you ever seen a duck swimming? What did it look like?").

Dialogic reading has been shown to produce larger effects on the oral language skills of children from middle- to upper-income families than a similar amount of typical picture book reading (Arnold, Lonigan, Whitehurst, & Epstein, 1994; Whitehurst et al., 1988). Studies conducted with children from low-income families attending child care demonstrate that child-care teachers, parents, or community volunteers using a 6-week small-group center-based or home dialogic reading intervention can produce substantial positive changes in the development of children's language as measured by standardized and naturalistic measures (Lonigan, Anthony, Bloomfield, Dyer, & Samwel,

1999; Lonigan & Whitehurst, 1998; Valdez-Menchaca & Whitehurst, 1992; Whitehurst, Arnold, et al., 1994) that are maintained 6 months following the intervention (Whitehurst, Arnold, et al., 1994). A large-scale longitudinal study of the use of dialogic reading over a year of a Head Start program for 4-year-olds showed large effects on emergent literacy skills at the end of Head Start that were maintained through the end of kindergarten; however, these positive effects did not generalize to reading scores at the end of second grade (Whitehurst, Epstein, et al., 1994, Whitehurst et al., 1999).

Experimental studies of programs designed to teach children phonological sensitivity show positive effects on children's reading and spelling skills (e.g., see Bus & van Ijzendoorn, 1999; for review). Phonological sensitivity training programs that have included letter knowledge training produced larger gains than did phonological sensitivity training alone (Ball & Blackman, 1988; Bradley & Bryant, 1985). The majority of these programs teach children how to categorize objects on the basis of certain sounds (e.g., initial phonemes). Other programs explicitly teach children phonemic analysis and synthesis skills. For example, Torgesen, Morgan, and Davis (1992) found that a 7-week group training program that taught children both analysis (e.g., identify initial, final, or middle sounds in words) and synthesis skills (e.g., say words after hearing their phonemes in isolation) resulted in larger gains in both phonological sensitivity and a reading analogue task than did training in synthesis skills alone. In addition, they found that both training groups performed better than did a group of control children who had listened to stories, engaged in discussions about the stories, and answered comprehension questions for an equivalent period.

Whereas most phonological sensitivity training studies have been conducted with children at the beginning stages of learning to read (i.e., kindergarten or first grade), Byrne and Fielding-Barnsley (1991a) found that preschool children (mean age = 55 months) exposed to 12 weeks of their *Sound Foundations* program (Byrne & Fielding-Barnsley, 1991b) demonstrated greater increases in phonological sensitivity

than did a group of control children exposed to storybook reading and a semantic categorization program, and some of these gains were maintained through the first and second grades (Byrne & Fielding-Barnsley, 1993, 1995). This intervention program consisted of teaching children six phonemes in the initial and final positions of words by drawing attention to the sound in words, discussing how the sound is made by the mouth, reciting rhymes with the phoneme in the appropriate position, and encouraging children to find objects in a poster that had the sound in the initial (or final) position. Worksheets in which children identified and colored items with the phoneme in the correct position were used, and the letter for the phoneme was displayed. A final stage of training introduced children to two card games that required matching objects on the basis of initial or final phonemes.

Evidence also points to the potential effectiveness of software designed to teach phonological sensitivity skills to children (Barker & Torgesen, 1995; Foster, Erickson, Foster, Brinkman, & Torgesen, 1994; Lonigan et al., 2000; Olson, Wise, Ring, & Johnson, 1997; Wise, Olson, Ring, & Johnson, 1998). Foster et al. (1994) conducted two experiments in which preschool and kindergarten children were randomly assigned to receive either their standard school curriculum or between 5 and 8 hours of exposure to *DaisyQuest* (Erickson, Foster, Foster, Torgesen, & Packer, 1992), a computer program designed to teach phonological sensitivity in the context of an interactive adventure game. Children in the experimental group in both studies demonstrated significant and large gains in phonological skills compared to the children in the no-treatment control group.

Lonigan et al. (2000) evaluated the effectiveness of an 8-week intervention using *DaisyQuest* with children attending Head Start. Compared to children who received the standard Head Start curriculum, children in the experimental group experienced significant growth in their ability to identify rhyme and to perform analysis tasks. Barker and Torgesen (1995) also examined the effectiveness of the *DaisyQuest* program with a group of at-risk first grade children who were randomly assigned to either an experimental or control group. Children in the ex-

perimental group received approximately 8 hours of exposure to the program, and children in the control group received an equal amount of exposure to computer programs designed to teach early math skills or other reading skills. Exposure to the *DaisyQuest* program produced significant and large improvements in children's phonological sensitivity and word identification skills compared to the control groups.

Conclusions

Children know a lot about reading before they begin formal reading instruction, and this knowledge provides the building blocks for learning to read and write. The developmental precursors of reading skills are already organized into outside-in and inside-out domains during the preschool period. Knowledge of print and phonological awareness is closely connected within the domain of inside-out skills and shows strong continuity over time, whereas oral vocabulary operates within a separately organized outside-in domain which shows even stronger developmental continuity. Although the outside-in and inside-out domains are connected (i.e., they covary) during the preschool years, by the time children are involved in formal reading instruction in first and second grade, the influence of the outside-in domain has waned and become indirect. The strong, direct correlates of reading success from the kindergarten period are inside-out skills.

Different aspects of the home literacy environment differentially affect outside-in versus inside-out skills. Shared reading, for example, primarily affects oral vocabulary, while rhyming, word-sound games, and exposure to alphabet materials primarily affect inside-out skills. Future efforts to prevent reading problems need to be sensitive to the differences between the inside-out and outside-in domains of emergent literacy and their developmental relationships.

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