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The Comprehensive Language Approach to Early Literacy: The Interrelationships Among Vocabulary, Phonological Sensitivity, and Print Knowledge Among Preschool-Aged Children

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This article describes 2 points of view about the relationship between oral-language and literacy skills: The *phonological sensitivity approach* posits that vocabulary provides the basis for phonological sensitivity, which then is the key language ability supporting reading, and the *comprehensive language approach* (CLA) posits that varied language skills interact with literacy knowledge and continue to play a vital role in subsequent reading achievement. The study included 533 Head Start preschool-aged children (M = 4 years 9 months) in 2 locations and examined receptive vocabulary, phonological awareness, and print knowledge. Partial correlational and regression analyses found results consistent with the CLA approach and evidence of a core deficit in phonological sensitivity, interpreted in a manner consistent with the CLA perspective.

Although substantial recent research addresses the relationship between oral language and literacy skills (e.g., for reviews, see Biemiller, 1999; Catts, Fey, Zhang, & Tomblin, 1999; Snow, Burns, & Griffin, 1998), researchers have worked from different assumptions about the nature of that relationship. One point of view, which we call the *phonological sensitivity approach* (PSA), is that general oral-language abilities, especially vocabulary, provide the critical basis for the emergence of phonological sensitivity, which thereafter is the key language skill. The other view, the *comprehensive language approach* (CLA), is that a variety of oral-language skills are critical in emergent literacy and continue to play vital roles in subsequent reading achievement. Note that this distinction pertains to the interrelationships among children's abilities, not to methods of instruction. This distinction between the PSA and the CLA echoes an earlier distinction between the autonomy hypothesis of metalinguistic awareness and the interaction hypothesis (Smith & Tager-Flusberg, 1982). When that distinction was made, researchers viewed phonological awareness[1] as just one aspect of metalinguistic awareness, and the debate was whether metalinguistic awareness was a distinctive type of linguistic functioning that develops independently from, and later than, basic linguistic acquisition and in conjunction with literacy (autonomy hypothesis) or whether such skills emerge at a young age, concomitant with other processes of language acquisition, and interact with and facilitate each other (interaction hypothesis).

CLA

A number of research paradigms posit that language acquisition is a complex French braid of abilities, including strands of phonology, semantics, syntax, discourse, reading, and writing that are commenced at various times and woven in with the other strands (see Dickinson & McCabe, 1991, and Scarborough, 2001, for such reviews). Several studies have examined the long-term impact of a variety of oral-language abilities on subsequent reading achievement and found evidence of substantial impact of many different abilities. Such predictive abilities include phonological awareness (see Footnote 1; reviewed in detail following), but also vocabulary (e.g., Anderson & Freebody, 1981; Bishop & Adams, 1990; Butler, Marsh, Sheppard, & Sheppard, 1985; Hart & Risley, 1995; Pikulski & Tobin, 1989; Scarborough, 1989; Share, Jorm, Mac-

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[1] We use the term *phonological awareness* to refer to the broad range of abilities related to awareness of the sound structure of language. When we discuss research that has focused on phonemic awareness, we use the more restrictive term *phonemic awareness.*

lean, & Matthews, 1984; Stahl & Fairbanks, 1986; Walker, Greenwood, Hart, & Carta, 1994; see Whitehurst & Lonigan, 2001, for review), syntax (for review, see Dickinson, 1987, and Scarborough, 2001; see also Scarborough, 1990, 1991a, 1991b), and discourse (Beals, 2001; Bishop & Edmundson, 1987; Fazio, Naremore, & Connell, 1996; Feagans & Applebaum, 1986; Menyuk et al., 1991; see Vernon-Feagans, Hammer, Miccio, & Manlove, 2001, for review). These distinct oral-language abilities are not necessarily developmentally independent. For example, evidence is beginning to indicate that the size of a child's vocabulary may play a role in bolstering the emergence of phonological awareness (Goswami, 2001; Metsala, 1999).

There is some evidence that oral-language abilities are closely related to the emergence of print knowledge and phonological ability in kindergarten (Bowey & Patel, 1988). In prior work, David K. Dickinson and colleagues (Dickinson & Tabors, 2001) conducted an 11-year longitudinal study of 74 Head Start children beginning when they were 3 years old. They were interested in examining a broad range of oral-language and literacy abilities with the working assumption that phonological abilities and print knowledge would be most important to children at the outset of literacy acquisition but that abilities such as receptive vocabulary, the ability to formally define words, and narrative skill would become more critical in middle elementary school years (Snow & Dickinson, 1991). As anticipated and consistent with others (Biemiller, 1999; Cunningham & Stanovich 1997), they found substantial long-term correlations of oral language with 4th- and 7th-grade decoding and reading comprehension. In addition, consistent with results reviewed by Scarborough (2001), children's narrative production, receptive vocabulary, and emergent literacy skills were significantly intercorrelated in kindergarten (Tabors, Roach, & Snow, 2001).

Bowey (1994) also examined kindergarten-aged children and found evidence of the interrelationships among phonological awareness, letter knowledge, word identification, and several measures of oral language (e.g., receptive vocabulary, sentence imitation). All the measures of oral language and literacy were significantly intercorrelated. When Bowey divided the children into novice readers and three groups of nonreaders who varied in letter knowledge, she found that novice readers scored higher than all groups of nonreaders on phonological sensitivity and vocabulary knowledge. However, when she controlled for differences in vocabulary knowledge, sentence imitation, and digit span effects, none of the differences in phonological sensitivity remained significant. These findings lend support to the point of view that, at least in kindergarten, this set of abilities is interrelated in important ways.

Other studies also have found that oral language is related to phonological sensitivity in the years prior to direct reading instruction and that language, especially vocabulary, plays an important role in supporting reading during the initial stage when decoding is the primary challenge facing children. In a preschool sample, Dickinson and Snow (1987) found interrelationships among measures of print knowledge, phonological sensitivity, and oral language. In a longitudinal study, Chaney (1992, 1994, 1998) followed 41 children from age 3 years through age 7. She gave children assessments of language comprehension, verbal ability, articulation, discrimination, word knowledge, sentence structure, five tasks testing phonological awareness, five for word awareness, two for structural awareness, and two of emergent literacy. When the children were at the end of first grade, she gave them tests of phonological segmentation, phoneme deletion, sound–symbol knowledge, word identification, and comprehension. At age 3, the assessments of metalinguistic awareness (phonological, word, and structural) were intercorrelated and were also correlated with overall linguistic skill (excepting articulation and/or discrimination). Metalinguistic skill, especially phonological awareness, correlated with literacy knowledge, but oral-language skills such as receptive vocabulary were also strongly correlated with literacy at age 3. Evidence of long-term contributions of language to early reading came from Chaney's (1998) follow-up study, which found that overall language development at age 3 was as strongly correlated with reading scores at age 7 as it had been with metalinguistic and print knowledge scores at age 3. In addition, metalinguistic skills and print knowledge at age 3 made significant contributions to reading achievement above and beyond that provided by language development.

Additional evidence of facilitative relationships between language and reading over the years when children begin learning to read comes from Mason, Stewart, Peterman, and Dunning (1992), who administered a set of tasks that assessed a range of children's oral-language and early print skills at the beginning of kindergarten. Assessments of these children through the third grade revealed that children's early oral-language skills showed increasing power over time in predicting their reading comprehension skill.

Researchers working from a speech and language perspective have accumulated mounting evidence of the key role of oral language in supporting reading, even during the early years. Catts et al. (1999) conducted a large-scale study of children followed from kindergarten through second grade and found that over 70% of poor readers had a history of language deficits in kindergarten and, further, that most of these had problems in both phonological processing and oral language. Although both phonological processing and oral language (a composite of oral vocabulary, grammatical completion, sentence imitation, and narrative recall) accounted for unique and significant variance in second-grade reading achievement, the contribution of oral-language abilities to reading achievement was as great or greater than that observed for phonological processing.

Similarly, Berninger, Abbott, Thomson, and Raskind, (2001) studied language, reading, and writing in somewhat older children (Grades 1–6) with documented reading and/or writing problems. They found many complex and significant interrelationships among these variables, which led them to conclude that functional reading and writing systems are separate but highly interdependent and draw on common, as well as unique, component language processes. They introduce the term *flexible orchestration*: "the different ways those common language processes may be orchestrated, depending on which functional system is activated" (Berninger et al., 2001, p. 64). Also, Storch and Whitehurst (2002) recently published analyses of a longitudinal study that followed a group of children from Head Start through the fourth grade. These analyses drew on a large sample that made possible the testing of alternative models of the relationship between early and later sets of skills. Using structural analysis, the authors concluded that reading development is best conceived of as the result of two distinct interacting factors, oral-language skills and code-related skills. The impact of oral-language skills was most apparent in the preschool years and again in third and fourth grades, but indirect effects were noted in first and second grades.

Finally, also working from a speech and language perspective, Scarborough (2001) conducted a meta-analysis of findings from 61 kindergarten research samples examining the impact of many aspects of oral language on subsequent reading abilities. She drew a number of conclusions, including that (a) during preschool, most verbal skills are well-correlated with each other, both concurrently and predictively, and (b) successful predictors of future reading abilities usually have not been confined to a single linguistic domain. She articulates the consequences of the controversy about whether oral-language skills other than phonological sensitivity are important only insofar as they enable children to develop phonological processing or whether these other skills continue to play an important role in children's reading achievement. Most important, she argues that targeted interventions with an inaccurate model of the relationship between oral language and literacy have not and will not be successful and recommends that researchers stop thinking about causality of reading only in terms of a linear chain of abilities.

In sum, there is evidence that phonological sensitivity, other language skills, and print knowledge are interrelated in the years before children begin receiving reading instruction, and there is evidence these relationships persist as children begin learning to read. However, there is far from general agreement about the nature of the relationships among language skills (e.g., vocabulary, syntax, and phonological processing and awareness) and between early and later literacy. We now turn to a point of view that accords primary importance to phonemic awareness.

PSA

Phonological sensitivity has long been seen as one aspect of language ability that is important to early reading, and a massive body of work now has established that it is a critical precursor, correlate, and predictor of reading achievement (Bryant, MacLean, & Bradley, 1990; Cronin & Carver, 1998; MacLean, Bryant, & Bradley, 1987; Speece, Roth, Cooper, & de la Paz, 1999; Stanovich, 1992; Torgesen, Wagner, & Rashotte, 1997; Wagner & Torgesen, 1987; Wagner, Torgesen, Laughon, Simmons, & Rashotte, 1993; Wagner et al., 1997; Vellutino & Scanlon, 2001). Phonological awareness is now established as important to children's ability to successfully focus on graphemes and to link them to phonemes (Adams, 1990; Bryant, Bradley, MacLean, & Crossland, 1989; Byrne & Fielding-Barnsley, 1991; MacLean et al., 1987; Siegel, 1998; Tunmer, Herriman, & Nesdale, 1988). Studies of older children who have great difficulty learning to read have highlighted the importance of phonemic awareness. One important related hypothesis is that a small percentage of children (as reviewed by Foorman & Torgesen, 2001, and by McCardle, Scarborough, & Catts, 2001) have serious deficiencies in phonemic awareness. One theory is that such children have a core deficit localized to phonemic awareness and this deficiency is modularized so that skills in other language areas are not able to compensate (as reviewed by McCardle et al., 2001; Siegel, 1998; Stanovich, 1988; Stanovich & Siegel, 1994). In our discussion and analyses, when we refer to the PSA we restrict ourselves to developmental work done with typical children. These are distinct hypotheses in that PSA is a hypothesis about the developmental progression of normally developing children whereas the core deficit view describes a small subgroup with atypical patterns of development.

Longitudinal Correlational Studies

Given the established importance of phonological sensitivity, a number of researchers have explored the early origins of its development. Shankweiler et al. (1999) focused on phonological processing and argued that "deficient skill in mapping between the alphabetic representations of words and their spoken counterparts is the chief barrier to comprehension of text, at least in learners who are still at relatively early stages of reading" (p. 70). This perspective has been widely influential and has shaped research methodology and analytic approaches in ways that have limited attention paid to the independent contributions of oral language during the early phase of reading development.

The most important line of work examining the relationship between language skills in the preschool years and the emergence of early reading is summarized in a model developed by Whitehurst and Lonigan (1998, 2001). This structural equation model indicates that during the preschool years, developmental precursors of reading skills are organized into inside-out skills (phonemes and graphemes) and outside-in skills (narrative, concepts, and vocabulary). The influence of outside-in skills is only to be observed in preschool and kindergarten and only then indirectly through their impact on the child's inside-out skills. As Whitehurst and Lonigan (2001) stated, "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" (p. 24). The strong, direct correlates of reading success from the kindergarten period are phonological and alphabetic in this view.

The Whitehurst and Lonigan (1998, 2001) model drew on data from several studies, including that of Lonigan, Burgess, and Anthony (2000). Drawing on two samples of preschool children, Lonigan et al. (2000) developed models of the interrelationships among measures of phonological sensitivity, oral language, and nonverbal intelligence. Oral language in this project included receptive and expressive vocabulary, sentence production, and grammar for younger children (mean age = 41 months) and grammatical production only for older children (mean age = 60 months). Their younger sample, the one most relevant to this article, was assessed at two points in time, but the oral-language measures were not administered the second time. For this group, three factors accounted for children's test performance at Time 1: phonological sensitivity, oral language, and nonverbal IQ, with evidence of significant overlap between oral-language and phonological sensitivity factors. Time 1 oral language and phonological sensitivity related to children's phonological awareness and literacy skills 18 months later. The preschool measures of phonological sensitivity and letter knowledge significantly predicted decoding at age 6 after controlling for grammatical sensitivity, the only oral-language measure shared across both samples. Note that although this result demonstrates the importance of phonological awareness, by testing oral language only at one point in time and by using a restricted range of measures of oral language, the research method limited the possibility of finding contributions of oral language. Further, the analytic approach simply controlled for language, thereby eliminating examination of its independent contribution.

It is important to note that, as discussed previously, recent structural analyses of Storch and Whitehurst's (2002) longitudinal data have examined the role of oral language from preschool through fourth grade in great detail, with the result being a new two-factor model of reading development that accords language an important role throughout the preschool–fourth grade period. Thus, although analyses of the data set collected when children in this study were younger exemplify what we are calling the PSA perspective, Storch and Whitehurst made it clear that it is not the position they currently hold.

In another longitudinal project, Lonigan, Burgess, Anthony, and Barker (1998) studied low- and middle-income 2- to 5-year-old children's phonological sensitivity in relationship to early reading. They administered a battery of measures of phonological sensitivity and oral-language measures of vocabulary and grammatical knowledge. Among the older children, who showed stable patterns of assessment, they found significant correlations between oral-language and phonological sensitivity measures. In a related study, Burgess and Lonigan (1998) analyzed data from 4- and 5-year-old middle-class Caucasian children that were collected at two points in time. At Time 1 they included tests of grammatical understanding and expression, four measures of phonological sensitivity, and two measures of letter knowledge. At Time 2, the grammatical oral-language assessments were dropped. Once again, phonological awareness predicted early reading after controlling for language, but the independent contribution of language from Time 1 was not examined. Similarly, in a study that followed children from kindergarten through fourth grade, Wagner et al. (1997) found increasingly strong correlations between measures of decoding and a vocabulary assessment, but in their regression analyses they simply used vocabulary as a control measure.

A longitudinal study by Torgesen, Wagner, Rashotte, Burgess, and Hecht (1997) provides an example of how the contribution of language abilities other than phonemic awareness has been overlooked in longitudinal studies of more advanced readers. These researchers conducted analyses of factors that predicted the reading growth of children between third through fifth grades, with the goal of determining the relative contribution of phonemic awareness as opposed to rapid automatic naming speed. Included among the measures used was the vocabulary subtest of the Stanford-Binet Intelligence Scale (Thorndike, Hagen, & Sattler, 1986). In regression analyses conducted with the full sample of fourth graders, the vocabulary measure was found to account for nearly as much variance in reading comprehension as measures of phonological awareness. Among fifth graders, it accounted for 10% of the variance in contrast to the 2% of variance accounted for by phonological awareness measures. The vocabulary findings were not discussed, doubtless because the vocabulary measure was viewed simply as a control for general intelligence.

Thus, studies of the emergence of phonological awareness during the preschool years and early reading period have consistently found that phonological awareness plays an important role in predicting early decoding, but because of choices of research measures and analytic methods, they have not fully explored the potential enduring contributions of oral language to early decoding.

One study that did use a variety of oral-language measures consistently during the initial reading period found that the relationship between oral-language and literacy skills may change over time. De Jong and van der Leij (1999) conducted a longitudinal study of Dutch children by using a variety of measures of phonological awareness, working memory, nonverbal intelligence, and receptive and productive vocabulary. They found significant correlations between a factor composed of the two vocabulary measures and measures of reading, but in regression analyses this factor was no longer significant once the measures of letter knowledge and nonverbal intelligence were entered. However, phonological awareness accounted for variation only during the first year of instruction, not in Grade 2. It may be important to note that compared with English, spoken Dutch maps well onto print, thereby making the use of decoding strategies especially effective.

Using a different methodological approach, Speece et al. (1999) examined phonological awareness along with a number of other measures of oral-language skill in kindergarten and first-grade children. They created four profiles of children's performances across their battery of language tasks and correlated scores of children in different clusters with reading and writing measures. Although they found some evidence that children in the high language profile perform better on reading measures, the frequency of superior performances was limited, leading them to conclude that phonological awareness may be of primary importance. However, they performed no separate analyses examining the impact of varied language measures on reading and writing of all the children in the four groups.

In a large study of the contribution of a range of abilities to early reading Vellutino et al. (1996) studied over 1,000 kindergarten children, among whom 15% were identified as poor readers. Children were assessed on phoneme segmentation, rapid naming, rapid articulation, syntactic processing, receptive vocabulary, memory, general intellectual functioning, attention, precursor and rudimentary reading skills, and math abilities. Poor readers were given daily tutoring, and most were found to be within or above the average range after one semester of remediation. Children who were difficult to remediate performed below easily remediated and nonremediated peers on kindergarten and first-grade tests evaluating phonological skills but not on tests evaluating visual, semantic, and syntactic skills. Note that this difficult-to-remediate group amounted to less than 2% of the original sample, and so might well be a distinct population. In separate analyses of the same data set, Scanlon and Vellutino (1997) compared 150 children rated as poor, average, and good readers and found stronger performance among good readers on assessments of sentence and word memory and semantic skills. They interpreted their results as indicative of a problem with verbal memory among low readers.

Thus, correlational studies that have examined children during the emergent reading period have found interrelationships between a variety of oral-language measures, measures of phonological sensitivity, and letter knowledge, but they gave only limited attention to the role of oral language. Although studies during the early reading period have found evidence highlighting the role of phonological sensitivity, especially among poor readers, Catts et al. (1999) argued that many results are largely an artifact of systematically excluding children with below-average IQs from investigations of good and poor readers because most IQ tests tap verbal abilities. Thus, it may be the case that researchers using the PSA do not find a broader range of oral-language abilities to be important because they do not look for them in a concerted way.

Training Studies

Of course the strongest evidence bolstering the view that phonological awareness is key to early reading success comes from training studies. These studies have established that phonological awareness plays a causal role in learning to read and have important implications for preschool education (see Pressley et al., 2001). Training 5- to 6-year-old children in phonological awareness has effectively boosted later reading achievement (Ball & Blachman, 1991; Bradley, 1988; Bradley & Bryant, 1983; McGuinness, McGuinness, & Donohue, 1995). Training preschool children in phonological skills even before beginning reading instruction has also proven effective (Lundberg, Frost, & Petersen, 1988). Further, there is considerable evidence that many children need instruction to lead them to the analytic approach to print and language such mappings require (Ehri & Robbins, 1992; Masonheimer, Drum, & Ehri, 1984).

Caution must be exercised, however, in promoting training in phonological awareness as a panacea for early reading instruction, because of conflicting conclusions from meta-analyses of training studies. One quantitative meta-analysis of 52 published studies involving training in phonemic awareness (Ehri et al., 2001) found that there was a large and significant impact of phonemic awareness instruction on acquisition of phonemic awareness, but a moderate, though still significant effect, for improving reading and spelling. This analysis also found, however, that disabled readers benefited significantly less than younger at-risk or normally progressing readers. Furthermore, they found that instruction in phonemic awareness was significantly more effective when it lasted from 5 to 18 hr rather than less or more; programs that offered 18 to 75 hr of instruction in phonemic awareness were only half as effective as those within the 5- to 18-hr range, despite common wisdom that the more a skill is promoted, the better children will learn it. Phonemic awareness instruction alone accounted for 6.5% of the variance in reading outcomes and rose to 10.0% when such instruction was combined with letters. It rose to 28.0% for preschoolers and 31.0% for long-term reading performance of at-risk students. Ehri et al. (2001) themselves caution that much variance in reading is left to be explained by other types of instruction, especially listening to storybooks for preschoolers.

Another quantitative meta-analysis of 36 studies ($N = 3{,}092$) testing effects of training programs on phonological awareness and of 34 studies ($N = 2{,}751$) testing effects on reading revealed the overall effect to be modest (Bus & van IJzendoorn, 1999). Specifically, experimentally manipulated phonological awareness explains about 12% of the variance in word-identification skills. The combined effect size for long-term studies of the influence of phonological awareness training on reading was much smaller than that. Training effects were stronger with posttests assessing simple decoding skills than with real-word identification tests, leading the authors to conclude that phonological awareness is an important but not a sufficient condition for early reading. Combining phonological awareness training with instruction in letter–sound knowledge has more powerful effects on subsequent literacy achievement than phonological awareness training alone (Bus & van IJzendoorn, 1999; Schneider, Roth, & Ennemoser, 2000). Perhaps an even broader approach to instruction, one incorporating more comprehensive language skills, would have even more powerful effects.

Interrelationships Among Precursors to Reading

Considerable evidence points to relationships between a variety of oral-language abilities and subsequent reading, with special attention given to phonological awareness. There is also substantial evidence pointing to the impact of literacy—broadly conceived—on language. Although longitudinal and phonological training studies largely examine a unidirectional hypothesis about the nature of the relationship between early precursors and subsequent reading ability, there is evidence that this relationship is bidirectional (Bowey, 1994; Burgess & Lonigan, 1998; Ehri, 1998; Wagner, Torgesen, & Rashotte, 1994). As many others have pointed out, the critical factor in the argument that literacy supports phonological awareness is that the process of learning how to read requires a focus on sound–symbol relationships (see Bowey, 1994, for review).

Reading books to preliterate children is most importantly a means of supporting language acquisition, which in turn may bolster phonological awareness. That is, shared reading does not directly lead to growth in phonological skills (Lonigan, Dyer, & Anthony, 1996; Raz & Bryant, 1990; Senechal, LeFevre, Thomas, & Daley, 1998; Whitehurst, 1996; Whitehurst & Lonigan, 2001). Growth in preschool phonological sensitivity relates to such things as parents' attempts to teach print (Senechal et al., 1998) and the frequency with which parents read for pleasure and children observe this (Lonigan et al., 1996) but not the frequency of shared reading (Lonigan et al., 1996; Senechal et al., 1998). However, children's oral-language skills are associated with storybook exposure but not with parents' attempts to teach print (Senechal et al., 1998). Dialogic shared reading is especially effective in enhancing children's oral-language skills (see Whitehurst & Lonigan, 2001, for review). Studies of the language children use when pretending to read carry multiple subtle indications of their awareness and growing control of language patterns (vocabulary, syntax, and discourse markers) found in books (Pappas & Brown, 1987; Purcell-Gates, 1988; Sulzby, 1985).

As complicated as this picture of the relationship of oral language and literacy is, the reality is even more so. Distinct oral-language abilities are themselves interrelated. For example, the extent to which children engage in particular kinds of discourse with their parents predicts their vocabulary growth (e.g., Beals, 2001; Peterson, Jesso, & McCabe, 1999). We already noted the finding that vocabulary growth predicts phonological awareness (Goswami, 2001; Metsala, 1999; Metsala & Walley, 1998). Quite possibly, important interrelationships exist that have been unexplored, ignored, or relegated to the level of nuisance by virtue of statistical control procedures. Of particular interest to the present project is the notion that phonological awareness may be a stimulus for vocabulary. Lewis Carroll's famous poem "Jabberwocky" works because phonemes carry meaning. Children with advanced phonological awareness can add this awareness to their arsenal of devices for determining the meaning of the many new words they encounter on a daily basis. Indeed, Beck, Perfetti, and McKeown (1982) argue that one way to increase vocabulary in older children is to increase children's awareness of words.

Our Approach

Much of the research we have reviewed pertains to the early reading era, when decoding is a primary concern and, with the notable exception of Chaney (1998) and Dickinson and Snow (1987), work done with preschool children has relegated language to the status of a control variable. In the current study we focus on the preschool period when children are gaining early knowledge of print while building their language skills and first acquiring ability to reflect on language. At this point we expected to find evidence of the impact of each of the large domains of receptive vocabulary, phonological awareness, and print knowledge on each other. In addition, we extend prior research by focusing on 4-year-olds who are at an early phase of learning to read. Past research has largely addressed abilities of early readers. The studies that have included preschool-aged children have been largely middle-class, Caucasian, and English-speaking samples covering a wider age span (e.g., Burgess & Lonigan, 1998), although Chaney (1992) systematically addressed variation in such abilities due to social class.

We hypothesized that after controlling for family background information, we would find a pattern of interrelationships among language, literacy, and print knowledge in 4-year-old children. That is, we anticipated that both aspects of the children's language that we assessed—receptive vocabulary and phonological sensitivity—would be relatively closely related to each other and that print knowledge would be related to both language skills. Such a pattern of results would be taken as support for the CLA, which argues that a broad range of oral-language skills supports both early and later reading.

We also examined the possibility that even among children in the early phase of becoming literate, after controlling for age and family demographic factors, we might find evidence indicating the presence of an early deficit specific to phonemic awareness. If the CLA approach is the correct way to view the interrelationships among language and literacy skills, we reasoned that a deficit specific to phonological sensitivity might alter the pattern of association between language and phonemic awareness and between these language skills and early literacy. In particular, among children with the lowest phonemic awareness scores, we might find that the relationship between language and literacy would be modified such that the ability of language to predict print-related skill would be reduced relative to children with normally developing phonemic awareness. Similarly we reasoned that if a child had a very limited vocabulary development, the relationship between these two language skills and early literacy might be altered in a manner parallel to that seen for children with low phonological sensitivity scores.

Method

Sites and Participants

The data reported in this article reflect the work of two of the four Quality Research Centers funded by the Head Start Bureau to examine Head Start program quality and its impact on children and families. These centers are the New England Quality Research Center for Head Start based at Education Development Center, Newton, MA, and the North Carolina Head Start Quality Research Center, based at the Frank Porter Graham Child Development Institute at the University of North Carolina at Chapel Hill. Although each center pursued its own research questions, the centers used several of the same research measures and collaborated to examine the questions addressed in this article.

The New England Quality Research Center worked with four Head Start programs to identify a total of 40 classrooms that would participate in the research. Parental permission slips were sent home with all children in these classrooms. For the permission slips that were signed and returned, decisions were made regarding which children to include in the study on the basis of the child's dominant language (only English and Spanish speakers were included in our sample) and gender (balance of boys and girls). A total of 350 children (176 boys, 174 girls) were assessed in the spring of the year. The average age of the children was 4.03 years, and the average child-to-adult ratio per household was 1.62. Fifty-nine percent of the children were White; 15%, African American; 7%, Asian American. The rest were of other ethnicities or no data were supplied regarding ethnicity. Forty-five percent ($n = 158$) were from bilingual homes; 54.9% ($n = 192$) were from English-only homes. Most mothers had a high school diploma or GED ($n = 104$, 29.7%) or at least some college ($n = 109$, 31.1%). Only 25.4% ($n = 89$) had not completed high school. Note that the mothers did not supply this information in 48 cases, so those values were imputed by using the mean value. Monthly income was between $500 and $1,500 on average.

The North Carolina center identified four Head Start programs that agreed to participate in the research. The research study was explained to all of the teachers in these programs, and 77% ($n = 68$) agreed to participate. Researchers sent letters describing the study and consent forms home to the parents of all the children in participating teachers' classrooms. If more than 8 families consented, we stratified the sample by gender and randomly selected 8 children (half boys and half girls, if possible) to participate. If 8 or fewer families consented, we included all of these children in the study. This process allowed the North Carolina center to assess 183 children (92 boys, 91 girls) in the spring. Of this sample, 84% were African American, 13% were European North American, 3% were Native American, and less than 1% were mixed race. The average child age was 4.71 years. There were an average of 1.61 children to adults in the household. Most mothers held at least a high school diploma or GED ($n = 42$, 23%) or had some college ($n = 100$, 55%), with only 22% ($n = 40$; 1 missing value) having less than a high school education. Their monthly income was between $1,000 and $2,000.

Assessment Tools

Early Phonological Awareness Profile (EPAP; Dickinson & Chaney, 1997a). This measure assesses children's ability to engage in phoneme deletion ("What is *foot* without the *f*?") and recognize and produce rhymes. This tool was developed by the New England Research Center on Head Start Quality. A principal-components analysis revealed a general Phonological awareness variable, which accounted for 59.6% of the total variance in the measure. The Cronbach's alpha for general phonological awareness (total EPAP score) was .93 on all data to date ($n = 984$). Cronbach's alpha for the Rhyme Recognition subscale was .92 for all data to date ($n = 984$); Cronbach's alpha for the Phoneme Deletion subscale was .94 for all data to date ($n = 984$).

Peabody Picture Vocabulary Test—III (PPVT–III; Dunn & Dunn, 1997). This well-established test was used to measure receptive vocabulary in English.

Emergent Literacy Profile (ELP; Dickinson & Chaney, 1997b). This measure assesses children's ability to read environmental print (e.g., to pick out McDonald's from the logo). Children receive one point for a semantically correct response and two for an exact response. Items varied in difficulty, with the hardest (e.g., *milk*, *bread*) tapping early decoding. ELP also assesses children's sense of what printed language looks like (e.g., their ability to pick the word out of a display such as *NNNT*, *W3#NJ*, *MILK*), to identify letters, and to write their name.

This tool was developed by the New England Research Center on Head Start Quality. The Cronbach's alpha ($n = 578$) on this test was .86.[2]

Control Variables

Because only the PPVT–III is scored taking age into account, age served as the first control variable. The New England sample contained a number of children from bilingual Spanish–English speaking homes, so this presence of bilingualism was treated as a control variable because of well-established risk factors for bilingual children. For example, the most recent National Assessment of Educational Progress (Donahue, Voekl, Campbell, & Mazzeo, 1999) revealed that at the end of high school, children from Spanish-speaking homes were performing at the same reading level as Caucasian students were at the end of eighth grade.

Gender also functioned as a control variable because a meta-analysis of a variety of children's verbal abilities revealed a significant, though small, gender difference; although gender differences are not consistently found, when they are, they reveal higher performance on the part of girls (Hyde & Linn, 1988).

We controlled for measures that reflect social class because much research has established that social class affects numerous aspects of the language children hear and exchange with their parents (e.g., Bee, Van Egeren, Streissbuth, Nyman, & Leckie, 1969; Farran, 1982; Farran & Haskins, 1980; Hart & Risley, 1995; Heath, 1983; Hess & Shipman, 1965; Hoff-Ginsberg, 1991; Schacter, 1979), as well as children's phonological awareness (Bryant, MacLean, & Bradley, 1990; Bryant, Bradley, MacLean, & Crossland, 1989; Dickinson & Snow, 1987; Wallach, Wallach, Dozier, & Kaplan, 1977; Warren-Leubecker & Carter, 1988) and literacy experiences (e.g., Chaney, 1994; Heath, 1983). In this project, we tracked social class by using two interval variables—mother's education and income, both derived from a parent interview. Mother's education was coded on a 3-point scale: 1 = *less than high school*, 2 = *high school diploma or GED*, and 3 = *at least some college*. Mothers were asked to report the income of the household for the last month. If there was no response they were asked to give an estimate using a 7-point-scale: 1 = *less than $250*; 2 = *$250–$500*; 3 = *$500–$1,000*; 4 = *$1,000–$1,500*; 5 = *$1,500–$2,000*; 6 = *$2,000–$2,500*; 7 = *over $2,500*.

The amount of language directed to children has often been found to have an impact on their verbal abilities (e.g., see Huttenlocher, Haight, Bryk, Seltzer, & Lyons, 1991). Because the amount of language directed to children is affected by the ratio of children to adults in their households, this also served as a control variable.

Procedure

The Quality Research Centers used trained data collectors to conduct all child assessments in one-on-one sessions that took place in a quiet area of the Head Start center, usually outside of the classroom. These sessions ranged from 20 to 60 min, depending on the child's ability level and attention to the tasks. The assessments were administered in the spring of the preschool year in the following order: PPVT–III, EPAP, and ELP.

Two analyses were performed to examine the validity of the CLA approach by assessing the relationships among language skills, phonological sensitivity, and literacy. We first conducted a partial correlational analysis in which we controlled for relevant background factors and examined that pattern of interrelationships among receptive vocabulary, early literacy, and phonological sensitivity. We then tested the hypothesis that vocabulary and phonological sensitivity account for unique variance when predicting early literacy. We used a hierarchical multiple regression model in which we first predicted ELP scores from the following six background variables, controlling for site: gender, bilingualism, household child-to-adult ratio, monthly income, mother's education, and the child's age. The second model added the PPVT–III scores, and the third model added phonological sensitivity as predictors. The increment to R^2 was examined for each model.

We then examined the effects of a deficit of one skill on the relationship between the other skill and literacy by using two analysis of covariance (ANCOVA) models. The first model categorized children as having low or normal phonological sensitivity. This is essentially a test of the core deficit hypothesis formulated from the CLA perspective. We hypothesized that among children with very low phonological sensitivity, vocabulary may have a reduced impact on children's developing literacy abilities. This model assesses the relationship between language skills and literacy for children with "normal" phonological sensitivity and children with very little evidence of acquiring such sensitivity. Because there are no national norms for the EPAP, we examined the data for a "natural" cutpoint. As illustrated in Figure 1, a "low" phonological sensitivity subgroup ($n = 78$) appears to be defined by EPAP scores of less then 8, which was 1 *SD* below the norm. Therefore, a new dichotomous variable was created that designated those children with EPAP scores of lower than 8 versus children with scores of 8 or higher. We then fit a generalized linear model that included data collection site, the background variables, phonological sensitivity categorized as low or normal, PPVT–III score, and the two-way interaction of categorized phonological sensitivity and PPVT–III. This ANCOVA model allows for separate effects of language on literacy for the two phonological sensitivity groups.

Working from the CLA perspective, we examined a second hypothesis regarding the impact of a language deficit on early literacy by considering the possible impact of low vocabulary on the relationship between phonological sensitivity and early literacy. A second ANCOVA model examined the relationship between phonemic awareness and literacy among children with normal and low language skills. For this analysis children were categorized as having normal or low language skills on the basis of their PPVT–III scores. *Normal language skill* was defined as a PPVT–III score of 85 or greater, which results in a "low group" with scores that are more than one standard deviation below the national mean. Forty-two percent ($n = 222$) of the children were categorized as having low language skills. As with the previous analysis, we fit a generalized linear model that included data collection site, the background variables, language categorized as low or normal, EPAP score, and the two-way interaction of categorized language and EPAP.

Results

Descriptive Results

Table 1 presents the descriptive statistics for the sample that included 533 children. The three major variables of interest were observed to vary from very low scores to, in the case of the measures of print knowledge and phonological awareness, the maximum possible score. Mean scores tended to be halfway between the observed extremes. It is of interest to note that although the variance is similar, the mean receptive vocabulary score (87; $SD = 15$) is considerably lower than that of the national norms, falling at the 19th percentile. Some children scored well below the standard score for the 10th percentile.

Correlations

Table 2 presents the bivariate correlations between all the variables included in the analyses. Receptive vocabulary, phonological sensitivity, and literacy are all moderately correlated with one another ($r > .40$). Literacy is shown to be correlated with all of the background variables and the data collection site. The partial

[2] Data from North Carolina were not available for the calculation of this estimate because they were not entered at the item level.

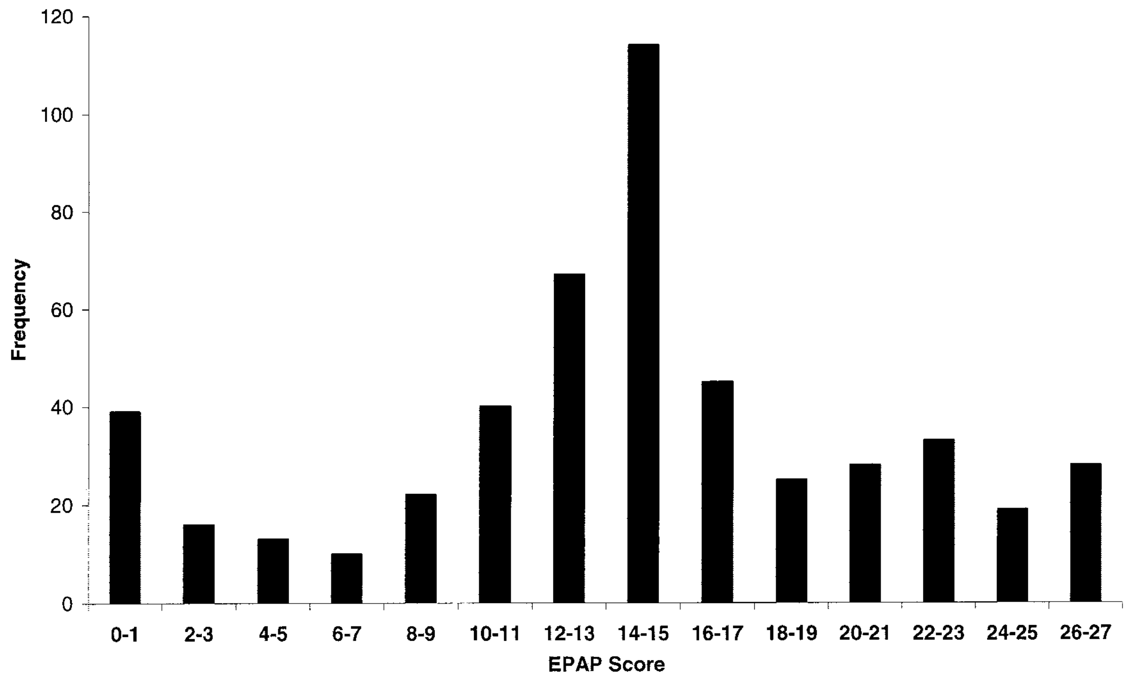

Figure 1. Sample distribution scores on the Early Phonological Awareness Profile (EPAP).

correlations show phonological awareness and receptive vocabulary to be equally correlated with literacy (r = .38). Thus, after controlling for relevant background variables, we found a pattern of moderate correlations among all three variables, a pattern that is consistent with the CLA perspective.

Hierarchical Multiple Regression Models

We used a hierarchical multiple regression model to test the CLA hypothesis that vocabulary continues to be a significant predictor of literacy skill when phonological sensitivity is considered. Three regression models were fit, the first controlled for site and included the following background variables: gender, bilingualism, household child-to-adult ratio, monthly income, mother's education, site, and the child's age. The second model added PPVT–III scores, and the third added the phonological awareness score. Results are shown in Table 2.

As can be seen from the results of Model 2 (see Table 3), vocabulary was a strong predictor (β = .37) and accounted for 15% of the variance. Under Model 3, vocabulary continued to be a significant, albeit weaker, predictor (β = .25). Under this model, both phonological sensitivity and vocabulary each accounted for about 7% of the total variance. As a whole, Model 3 accounted for approximately 42% of the total variance. This analysis provides support for the CLA approach in that it demonstrates that both language and phonological sensitivity are independent predictors of literacy.

Table 1
Sample Description

Variable entered	%	*M*	*SD*	Range
Print knowledge (ELP)		22.70	9.42	4.00–44.00
Phonological awareness (EPAP)		13.96	6.67	0.00–27.00
Receptive vocabulary (PPVT–III)		87.43	15.14	40.00–131.00
Site (EDC)	66			
Background variable				
Age[a] (years)		4.30	0.63	2.66–5.58
Gender (girl = 1)	50			
Spanish speaker (yes = 1)	30			
Maternal education[b]		2.16	0.78	1.00–3.00
Income[c] (in dollars)		4.08	1.52	1.00–7.00
Child-to-adult ratio		1.61	1.04	0.17–8.00

Note. ELP = Emergent Literacy Profile; EPAP = Early Phonological Awareness Profile; PPVT–III = Peabody Picture Vocabulary Test (3rd ed.); EDC = Education Development Center.
[a] Reported in the fall; children were 5–6 months older when assessed. [b] 1 = *less than high school (HS)*; 2 = *HS diploma or GED*; 3 = *at least some college*. [c] 1 = *<$250*; 2 = *$250–$500*; 3 = *$500–$1,000*; 4 = *$1,000–1,500*; 5 = *$1,500–$2,000*; 6 = *$2,000–$2,500*; 7 = *≥$2,500*.

ANCOVA Model

We used two ANCOVA models to examine the effects of a deficit of one skill on the relationship between the other skill and literacy. The first model categorized children as having low or normal phonological sensitivity. This is a test of the core deficit hypothesis formulated from the CLA perspective that among children with very low phonological sensitivity, vocabulary has reduced impact on children's developing literacy abilities. This model allows PPVT–III scores to a have unique contribution for each of the phonemic awareness groups. If the effect of PPVT–III scores is similar for each group, the interaction term will not be statistically significant.

As can be seen in Table 4, the two-way interaction of PPVT–III scores and categorized phonemic awareness is statistically signif-

Table 2
Bivariate and Partial Correlations

Variable	1	2	3	4	5	6	7	8	9	10
					Bivariate correlations					
1. Print knowledge (ELP)	—									
2. Phonological awareness (EPAP)	.51***	—								
3. Receptive vocabulary (PPVT–III)	.42***	.51***	—							
4. Site (EDC)	−.13**	.01	.02	—						
Background variable										
5. Age in years	.42***	.26***	.03	−.58***	—					
6. Gender (girl = 1)	.11*	.09*	−.03	.00	.00	—				
7. Spanish speaker (yes = 1)	−.24***	−.17***	−.39***	.47***	−.27***	.04*	—			
8. Maternal education	.22***	.20***	.22***	−.16***	.17***	.01**	−.22***	—		
9. Income	.12**	.09*	.10*	−.30***	.23***	.03*	−.17***	.15***	—	
10. Child-to-adult ratio	−.11**	−.01	−.07	.00	.00	.04*	.04	−.02	.00	—
					Partial correlations[a]					
2. Phonological awareness (EPAP)	.383***									
3. Receptive vocabulary (PPVT–III)	.387***	.485***								

Note. ELP = Emergent Literacy Profile; EPAP = Early Phonological Awareness Profile; PPVT–III = Peabody Picture Vocabulary Test (3rd ed.); EDC = Education Development Center.
[a] Controlling for site, gender, bilingualism, child-to-adult ratio, monthly income, mother's education, and the child's age.
* $p < .05$. ** $p < .01$. *** $p < .001$.

icant. Among the children with normal phonemic awareness, mean literacy scores increased by 0.26 points for each additional point achieved on the PPVT–III ($p = .026$). However, among the children with low phonemic awareness, mean literacy scores were increased by only 0.10 points for each additional point achieved on the PPVT–III ($p = .058$). The fact that the effect of PPVT–III among children with low phonemic awareness did not achieve statistical significance may be due to a lack of power. These results are illustrated in Figure 2, which graphs the relationship between literacy and vocabulary for children defined as having low and normal phonological sensitivity. Because we were concerned that the youngest children in our sample might show a different pattern of interrelationships among variables, we conducted the same analysis but eliminated all children who were younger than 4 years at the time of testing. This analysis yielded the same results as the one that included the full sample.

Table 3
Prediction of Early Literacy Scores by Using Language Variables, Controlling For Demographic Variables

Variable	Model 1	Model 2	Model 3
	Standardized estimate (β)		
Site (FPG)	0.28	−0.17*	−0.11*
Background			
Age (years)	0.50	0.48**	0.39*
Girl	0.12	0.12**	0.10*
Spanish speaking	−0.20	−0.03	−0.03
Mother's education	0.13	0.08*	0.06
Income	0.03	0.00	−0.00
Child-to-adult ratio	−0.11	−0.09*	−0.09*
PPVT–III		0.37**	0.25**
EPAP			0.25**
	Model statistics		
F	28.46***	40.38***	42.02***
Error df	525	524	523
R^2	.28	.38	.42
ΔR^2		.10	.04

Note. FPG = Frank Porter Graham Child Development Institute; PPVT–III = Peabody Picture Vocabulary Test (3rd ed.); EPAP = Early Phonological Awareness Profile.
* $p < .05$. ** $p < .01$. *** $p < .001$.

The second ANCOVA model categorized children as having low or normal language skills. The two-way interaction between EPAP scores and categorized language skills allows EPAP scores to a have unique contribution for each of the language groups. As can be seen in Table 4, the interaction term is statistically significant ($\beta = .26$; $p = .01$). Although phonemic awareness skills predict literacy in both language groups, the effect is stronger among those with normal language skills ($\beta = .55$; $p < .001$) than among those with low language skills ($\beta = .29$; $p < .001$). Figure 3 illustrates the relationship between EPAP scores and literacy for children in each group. It is important to note that the EPAP ranges are the same for both groups in that a considerable number of children with low vocabulary skills have normal to high phonetic skills.

Discussion

In this article, we argued that most studies of early literacy during the preschool years have failed to fully examine the interrelationships among abilities and thus have underestimated the contribution of oral language to early reading. We take what we have dubbed the *CLA* to the study of receptive vocabulary, phonological awareness, and early print knowledge in children at an early point of acquiring literacy. Results of two analyses supported the CLA perspective when applied to the complete sample. Cor-

Table 4
Analysis of Covariance Models Examining the Effects of the Interaction Between Vocabulary Skills and Phonemic Awareness Skills on Literacy

Variable	Model 1		Model 2	
	β	*SE*	*β*	*SE*
Site (FPG)	2.83**	0.48	2.37*	0.95
Background				
Age (years)	6.80***	0.64	5.58***	0.66
Girl	2.06**	0.65	1.59*	0.64
Spanish speaking	−0.44	0.90	−1.21	0.86
Mother's education	0.85	0.43	0.87*	0.42
Income	−0.07	0.23	−0.05	0.22
Adult:child ratio	−0.79*	0.31	−0.89**	0.31
PPVT–III	0.10	0.06		
Categorical phonemic awareness (normal = 1)	4.11***	1.21		
PPVT–III × Categorical Phonological Awareness (PA)	0.13*	0.06		
PPVT–III slope, normal PA	0.24*	0.03		
PPVT–III slope, low PA	0.10	0.06		
EPAP			0.29***	0.08
Categorical language (normal = 1)			3.57***	0.75
EPAP × Categorical Language			0.26*	0.10
EPAP slope, normal language			0.55***	0.07
EPAP slope, low language			0.29***	0.08

Note. Model 1 examines the relationship between vocabulary skills and literacy for children with normal and low phonemic awareness. Model 2 examines the relationship between phonemic awareness and literacy for children with normal and low vocabulary skills. FPG = Frank Porter Graham Child Development Institute; PPVT–III = Peabody Picture Vocabulary Test (3rd ed.); EPAP = Early Phonological Awareness Profile.
* $p < .05$. ** $p < .01$. *** $p < .001$.

relational analysis revealed that that all three abilities are significantly interrelated. Further, a regression analysis revealed that vocabulary accounted for the same amount of unique variance as phonological sensitivity.

Working within the CLA perspective, we then examined a novel version of the core deficit hypothesis. We examined the possibility that there might be subgroups of children who experience special difficulty with a selected language domain, phonological awareness or vocabulary, and that in these groups the relationship between language skills and early literacy seen among typically developing children might be disrupted. Two ANCOVAs examined this new variation of the core deficit hypothesis. We found that among young children with very low phonological sensitivity, vocabulary had less impact on literacy growth than it did among children with normally developing phonological sensitivity. Likewise, among children with low vocabulary, we found that phonological sensitivity was a less potent predictor of early literacy than among children with normally developing vocabulary.

The Children

We chose to study a low-income population, many of whom were on the verge of entering school, because of the need to better understand the early phase of literacy of this group.

As shown in Table 1, at the end of Head Start, children in this sample were not performing at levels that would guarantee their successful acquisition of literacy. The mean receptive vocabulary score was at the 19th percentile for national norms. Print knowledge was 23 out of a possible 44. For children this age, we expected a score of 33, which might reflect a knowledge of 7 out of 8 instances of environmental print, 4 out of 4 on a task requiring children to recognize words as distinctive symbols, 16 out of 24 displays of letter knowledge (naming some upper- or lowercase letters or pointing to letters whose name is given), and writing their name. Such a score would represent far from complete print knowledge, but even that was not achieved.

The phonological awareness tapped by the EPAP used here consisted of scores up to 14 for a very basic deletion task and 13 for a rhyming task, both of which are rather low-level types of phonological awareness (Burgess & Lonigan, 1998). A child this age who is making strong progress would have found the deletion task easy and would have been able to identify rhyming pairs and generate rhyming pairs. Such a child would have received a score of 27, nearly double the mean of 14 that we found. These findings are particularly sobering because there is abundant evidence from longitudinal–correlational and training studies that phonological processes are remarkably stable across the elementary school period (Torgesen & Burgess, 1998; see Whitehurst & Lonigan, 2001, for review). For example, year-to-year stability coefficients for phonological sensitivity have been found to range from .83 (kindergarten to first grade) to .95 (second to third grade and third to fourth grade; Wagner et al., 1994).

Lonigan et al. (2000) found significant developmental continuity of oral-language, print-knowledge, and phonological-sensitivity skills from early to late preschool and from late preschool to kindergarten or first grade, particularly for letter knowledge and phonological sensitivity—the only unique predictors of decoding. There also is considerable consistency from first grade to the later elementary grades in children's decoding skill (Dickinson, Tabors, & Roach, 1996; Juel, 1988; Stanovich, 1986; Storch & Whitehurst, 2002). Remarkably, in one study 1st-grade reading ability was a strong predictor of a variety of 11th-grade measures (and of all of the measures) of reading experience and ability, even when measures of cognitive ability were partialed out (Cunningham & Stanovich, 1997).

Background Factors

In order to understand sources of children's shortcomings in the skills associated with later literacy, it is important to take into account important features of the children's families. Our data included data about children's families, and our results provide information about the relationship between demographic factors among low-income populations and children's development. As anticipated, maternal education and monthly income were both associated with all three outcomes echoing the findings of much past research on the detrimental effects of poverty on children's development, and evidence that vocabulary is particularly sensitive

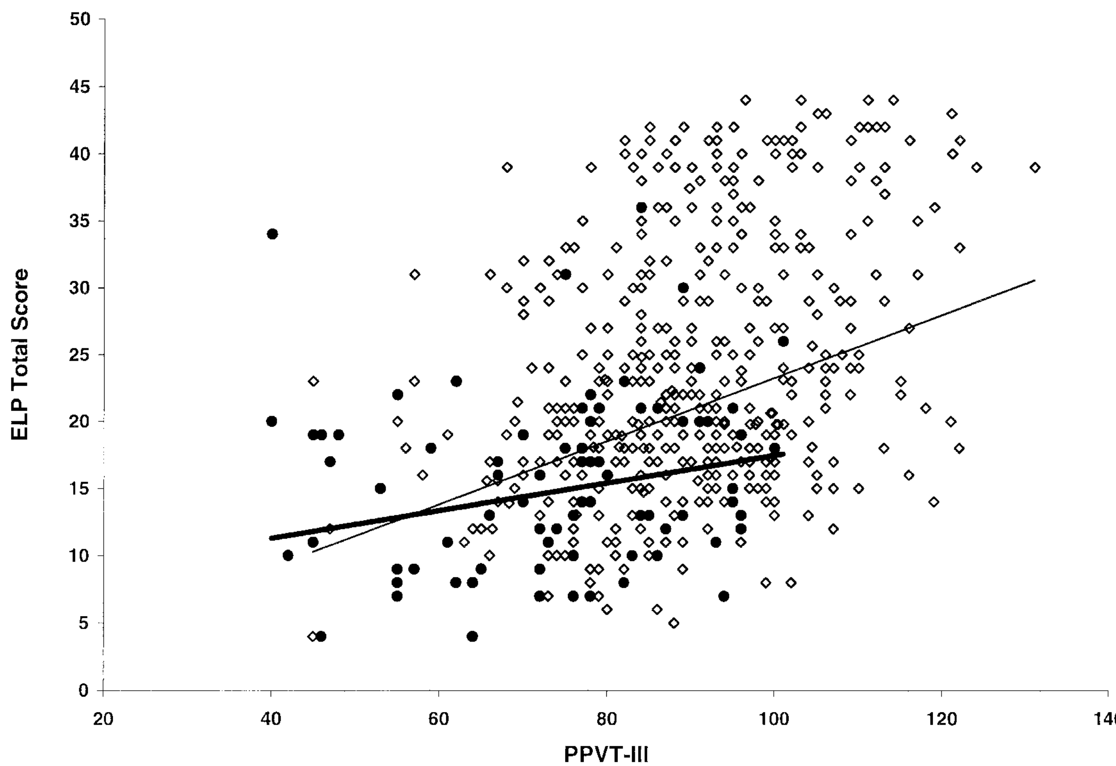

Figure 2. Results from analysis of covariance Model 1: Actual and predicted early literacy scores for children with low and normally developing phonological sensitivity as a function of receptive vocabulary scores. Predicted literacy scores are adjusted for study site, gender, bilingualism, child-to-adult ratio, monthly income, mother's education, and the child's age. Solid circles and the thick line represent low phonemic awareness (actual and predicted ELP scores, respectively); diamonds and the thin line represent normal phonemic awareness (actual and predicted ELP scores, respectively). ELP = Emergent Literacy Profile; PPVT–III = Peabody Picture Vocabulary Test (3rd ed.).

to these negative effects (e.g., Bee et al., 1969; Bryant, MacLean, & Bradley, 1990; Bryant, Bradley, MacLean, & Crossland, 1989; Chaney, 1994; Dickinson & Snow, 1987; Duncan & Brooks-Gunn, 1997; Farran, 1982; Farran & Haskins, 1980; Hart & Risley, 1995; Heath, 1983; Hess & Shipman, 1965; Hoff-Ginsberg, 1991; Schacter, 1979; Wallach et al., 1977; Warren-Leubecker & Carter, 1988). Child-to-adult ratio, a rough measure of the availability of adults to interact with children, was only weakly associated with one variable, print knowledge. This result suggests that it is likely the quality of interactions that parents have with their children is of paramount importance (Huttenlocher et al., 1991; Tabors, Snow, & Dickinson, 2001).

We also found that bilingualism was associated with reduced levels of performance on all three measures, with these effects being strongest on receptive vocabulary in English. Of course, our data reflect only half of the picture for these children because bilingual children had a vocabulary in Spanish that was not tapped in these analyses. Finally, gender was only weakly related to print knowledge and to phonological sensitivity and was unrelated to receptive vocabulary. The slightly stronger performance among girls is consistent with much prior research (see Hyde & Linn, 1988, for review).

Examination of the CLA

The CLA perspective theorizes that the three abilities we examined—vocabulary, phonological sensitivity, and print knowledge—are related and mutually reinforcing. Our data do not allow full examination of this position because they are from one point in time. To examine this position, we first used partial correlation to examine patterns of interrelationship after controlling for age and home background factors.

Partial correlational analysis. We found that receptive vocabulary and phonological sensitivity were correlated .49. This finding can be interpreted as supporting the lexical restructuring hypothesis, which posits that vocabulary growth fosters the emergence of phonemic awareness (Goswami, 2001; Metsala, 1999; Metsala & Walley, 1998). In addition, this finding supports what we have dubbed the "Jabberwocky effect." It may be that children with a keen sense of units of words can use that knowledge to decipher new words, tuning into the parts of those new words that have meaning for them. For example, a child who learns sets of words that include a common prefix such as *un-* (e.g., *unhappy*, *unkind*) may be able to use this tacit knowledge to search for clues to new words such as *unable*.

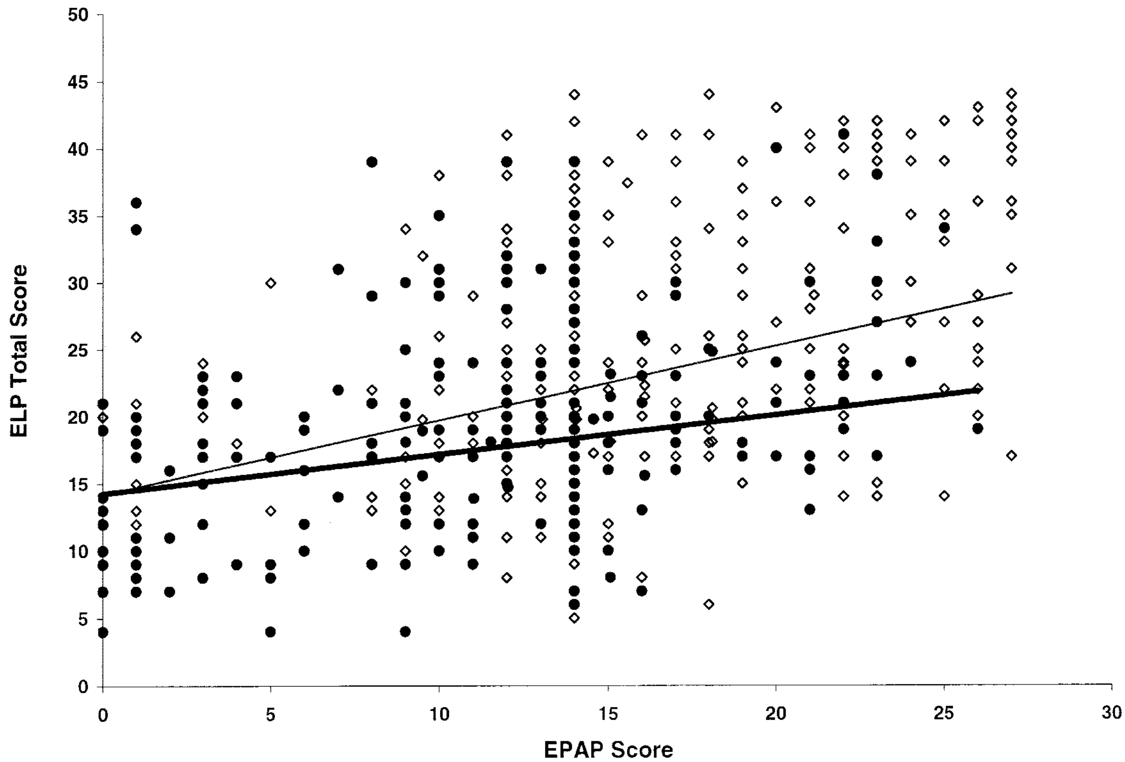

Figure 3. Results from analysis of covariance Model 2: Actual and predicted early literacy scores for children with low and normally developing vocabulary skills as a function of phonemic awareness scores. Predicted literacy scores are adjusted for study site, gender, bilingualism, child-to-adult ratio, monthly income, mother's education, and the child's age. Solid circles and the thick line represent low language skills (actual and predicted ELP scores, respectively); diamonds and the thin line represent normal language skills (actual and predicted ELP scores, respectively). ELP = Emergent Literacy Profile; EPAP = Early Phonological Awareness Profile.

We assessed early literacy by using a measure that included a task that examined ability to "read" environmental print, familiarity with printed language, letter knowledge, and early writing. Our partial correlational analysis found that phonological sensitivity was modestly related to early literacy ($r = .38$), after controlling for age and family background variables. This result is consistent with prior research indicating that the relationship between phonological awareness and print knowledge is bidirectional, with print knowledge supporting phonemic awareness (Bowey, 1994; Bowey & Francis, 1991; Burgess & Lonigan, 1998; Ehri, 1998; Johnston, Anderson, & Holligan, 1996; Lonigan et al., 2000; Stahl & Murray, 1994; Wagner et al., 1994, 1997), at least up until the end of kindergarten (de Jong & van der Leij, 1999).

The correlation between phonological sensitivity and early literacy also is in accord with the abundant prior research pointing to the important role of phonemic awareness to early literacy (e.g., Adams, 1990; Bryant et al., 1989; Bryant, MacLean, & Bradley, 1990; Byrne & Fielding-Barnsley, 1991; Cronin & Carver, 1998; MacLean et al., 1987; Speece et al., 1999; Stanovich, 1992; Tunmer et al., 1988; Vellutino & Scanlon, 2001; Wagner & Torgesen, 1987; Wagner et al., 1993, 1997).

From our partial correlational analysis, we also found that print knowledge was related to vocabulary at the same modest level as phonological sensitivity ($r = .38$), after controlling for age and family background variables. This result adds to the body of work demonstrating strong relationships between vocabulary and reading skills (e.g., Bishop & Adams, 1990; Butler et al., 1985; Hart & Risley, 1995; Lonigan et al., 2000; Pikulski & Tobin, 1989; Scarborough, 1989; Shankweiler et al., 1999; Share et al., 1984; Siegel, 1998; Stahl & Fairbanks, 1986; Tunmer et al., 1988; Vellutino & Scanlon, 2001; Wagner et al., 1993, 1997; Walker et al., 1994; see Whitehurst & Lonigan, 2001, for review). For young children in the age range of our study, much research has established the impact of reading to children on their vocabulary and literacy skills, most notably and directly in the dialogic reading program of Whitehurst and his colleagues (see Whitehurst & Lonigan, 2001, for review).

Hierarchical regression analysis. To further explore the interrelationships among our language and literacy variables, we used hierarchical regression to test a hypothesis generated by the CLA perspective. CLA claims that language, with vocabulary being a key element and the one that we measured, plays a major role in supporting literacy initially and over time. In contrast, PSA views vocabulary as a platform from which phonemic awareness is "launched." To test these CLA points of view, we regressed our measure of literacy on our measures of vocabulary and phonological sensitivity after we controlled for age and home demographic factors. The results supported the CLA perspective in that we found language to be a strong predictor ($\Delta R^2 = .15$) when entered after the control variables and that language and phonological sensitivity were equally significant predictors once both were in the model ($\Delta R^2 = .07$).

Thus, as noted previously, our data again support the importance of phonological sensitivity and vocabulary to literacy development. What is noteworthy is our finding that among the 3- and 4-year-olds in our sizable sample, vocabulary plays a role equal to that of phonological awareness in predicting print knowledge. In this respect our work is congruent with the CLA, which finds that oral language equals or outperforms phonological awareness in predicting print knowledge (e.g., Catts et al., 1999; Chaney, 1992, 1994, 1998). These findings also are consistent with the two-factor model of literacy development (Storch & Whitehurst, 2002). Our findings add to prior work on the role of language and phonological sensitivity literacy in that most prior research has examined early readers and the major studies of children were of children across a wide span from ages 2–5 (Burgess & Lonigan, 1998; Lonigan et al., 2000), whereas we focused on 3- and 4-year-olds. Furthermore our data come from a sample exclusively from low-income homes and we controlled for home background factors. Our results also are consistent with the newly articulated two-factor model proposed by Storch and Whitehurst (2002), though the CLA view describes in more detail varied interactions that might be found among print and language-related skills.

The Notion of Core Deficit From the CLA Perspective

The extensive attention that has been accorded to phonemic awareness is at least partly the result of the fact that deficiencies in this capacity have repeatedly been found to be associated with reading deficiencies. The strongest evidence for the impact of deficiencies in phonemic awareness is that associated with the core deficit hypothesis, which holds that a small group of children have serious deficiencies in phonemic awareness abilities. These problems are encapsulated within cognitive–linguistic systems that cannot easily be penetrated or supported by other systems (reviewed by Siegel, 1998; Stanovich, 1988; Stanovich & Siegel, 1994). To our knowledge, prior research has not attempted to determine whether there is evidence of such deficiencies among children when they are just beginning to understand print and to develop sensitivity to the sound system of language.

Working from a CLA perspective, we theorized that if a child has a serious deficiency in a language stand that supports literacy, this deficiency might limit the extent to which the two language abilities work in tandem to support early literacy. To test this hypothesis, we identified a group of children with low scores on our phonological sensitivity assessment task and another group with low vocabulary scores. Using ANCOVA, we found that language was a much stronger predictor for children with normal phonological sensitivity ($\beta = .24$) than for children with low phonological sensitivity ($\beta = .10$). Using a separate ANCOVA model, we found that phonological sensitivity was a much stronger predictor for children with normal language skills ($\beta = .55$) than for children with low language skills ($\beta = .29$). These findings are consistent with the version of the core deficit view that we generated from the CLA point of view. They suggest that among normally developing children, literacy is supported by mutually facilitative language skills, but that among some children with special difficulties, there may be modularized difficulty specific to one language area (e.g., phonological awareness, vocabulary), with the impact of this deficiency appearing even as children are first beginning to become literate.

It is noteworthy that our results parallel some of the results reported by Torgesen, Wagner, Rashotte, Burgess, and Hecht (1997). They conducted analyses that included their full sample of fourth and fifth graders and separate analyses that examined the lowest 20% of their sample. At fourth grade, the power of vocabulary to predict reading comprehension disappeared when only the lowest group was examined, mirroring the pattern we found. Interestingly, at fifth grade, the reverse was found, with vocabulary accounting for more variance in predicting reading comprehension among the lowest group than for the full group, accounting for a statistically significant 18% of the variance in contrast to the statistically nonsignificant 2% accounted for by phonological awareness measures. Such findings highlight the importance of conducting studies that include careful consideration of varied language abilities among diverse groups of children at all ages.

Caveats and Conclusions

Our conclusions must be tempered by the fact that our data are cross-sectional and correlational and that although our measures of phonological sensitivity and early literacy have been used with large numbers of low-income children, they are not nationally normed or standardized. Further, it must be noted that our sample includes only children from low-income homes, a group in which the mean vocabulary is far below the norm for children in the United States. Our findings might not generalize to a sample with stronger vocabulary. Holding these caveats in mind, we tentatively conclude that the CLA best describes the role of the language measures we used in supporting early literacy development. Further, the strength of this association may be moderated by the presence of groups of children who are experiencing significant problems with one specific aspect of language.

Methodological Impact

In reviewing the work that has been done on phonological awareness, we were struck by the extent to which findings may have been affected by methodology. Those working in the PSA tradition tend to use limited measures of oral language, sometimes limited solely to one arena such as grammatical awareness. Those within that the CLA perspective have tended to use a broader range of measures of language (e.g., vocabulary, grammar, narrative). This is a practice we applaud, but our current study itself suffers from the fact that its only measure of language was receptive vocabulary. Thus, our findings supporting the CLA position provide empirical support only for the lexical domain in relationship to phonological awareness and print knowledge.

However, long-term studies that have examined the relationship of several aspects of language to literacy show that the payoff for examining many aspects of oral language continues even into high school years. For example, a longitudinal study of language and literacy development found consistent significant and strong correlations between oral narrative production, production of formal definitions, and receptive vocabulary and fourth- and seventh-grade reading comprehension (Tabors, Snow, & Dickinson, 2001), with the interrelationships significantly increasing in strength (Dickinson & McCabe, 2001). Mason et al. (1992; like Storch & Whitehurst, 2002) found that children's kindergarten oral-language skills showed increasing power in predicting their reading comprehension skill in third grade. In a study that extended into the high school years (Snow, Barnes, Chandler, Goodman, & Hemphill, 1991), such relationships between oral-language and literacy skills continued to be strong.

Implications for Instruction

As our sample makes evident, low-income children are at a serious disadvantage with respect to vocabulary acquisition. If the CLA perspective is correct, then such shortcomings in children's vocabulary development may place serious limits on the initial literacy development of many children—especially those with the lowest levels of vocabulary. The same concerns hold for children's early phonological sensitivity. Further, Dickinson and McCabe (2001) have argued that the system of interrelated language and cognitive systems that children create as they first become literate may become increasingly well organized with time. If children have significant gaps in some portion of this system at an early point, they may fail to create the robust literacy systems needed for later literacy.

As preschool programs increasingly focus on literacy instruction, it is essential that we do not further limit the support these children receive for vocabulary development. Preschool classrooms can play an important role in supporting language development (Dickinson & Tabors, 2001; Tabors, Snow, & Dickinson, 2001) and, increasingly, preschool classroom teachers are bolstering children's early phonological awareness abilities. As preschool classrooms target the prerequisites for early literacy, it is essential that vocabulary and other language skills not be seen simply as capacities that are needed to trigger phonological awareness; rather preschool, kindergarten and primary grade teachers must strive to support acquisition of language abilities as they also provide code-related instruction that also is critical to successful reading (Storch & Whitehurst, 2002). As researchers continue to study these issues, we need to better understand environmental supports for the development of all these abilities and to determine how much change it takes in environmental supports to stop the daunting cycle of poverty and underachievement that we as a nation face today.

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The Publications and Communications Board of the American Psychological Association announces the appointment of two new editors for 6-year terms beginning in 2005:

- *Journal of Consulting and Clinical Psychology:* **Annette M. La Greca,** PhD, ABPP, Professor of Psychology and Pediatrics, Department of Psychology, P.O. Box 249229, University of Miami, Coral Gables, FL 33124-0751.
- *Developmental Psychology:* **Cynthia García Coll,** PhD, Brown University, 21 Manning Walk, Providence, RI 02912.

Electronic manuscript submission. As of January 1, 2004, manuscripts should be submitted electronically via the journal's Manuscript Submission Portal. Authors who are unable to do so should correspond with the editor's office about alternatives. Portals are available at the following addresses:

- For *Journal of Consulting and Clinical Psychology,* submit via www.apa.org/journals/ccp.html.
- For *Developmental Psychology,* submit via www.apa.org/journals/dev.html.

Manuscript submission patterns make the precise date of completion of the 2004 volumes uncertain. Current editors, Mark B. Sobell, PhD, and James L. Dannemiller, PhD, respectively, will receive and consider manuscripts through December 31, 2003. Should 2004 volumes be completed before that date, manuscripts will be redirected to the new editors for consideration in 2005 volumes.