A Longitudinal Study of Reading Development of Canadian Children from Diverse Linguistic Backgrounds

Penny Chiappe
University of California, Irvine

Linda S. Siegel
University of British Columbia

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Abstract

This study examined the development of reading and reading-related skills for native and nonnative speakers of English through the first and second grades. Tasks assessing reading, phonological, and language processing were administered to 36 native English speakers (NS) and 38 children who spoke English as a second language (ELL). Both ELL and NS children showed similar patterns of growth and achievement on measures of word recognition and phonological processing. Error analyses revealed that children from both language groups used similar strategies in reading unfamiliar words. Furthermore, the same first-grade variables—pseudoword reading and phonological awareness—were important contributors to reading skill for children from both language groups. Therefore, the findings from this sample suggested that word recognition in English develops in a similar way for NS and ELL children from middle-class backgrounds.

Stages in Learning to Read

Numerous models of reading acquisition within one's native language propose that children progress through a series of stages when they learn to read (Chall, 1983; Ehri, 1997; Frith, 1985; Gough, Juel, & Griffith, 1992). Although these models may vary in the number of stages they propose, most include three basic features: that children begin reading with a logographic, or whole-word approach; followed by an initial, phonological decoding stage; and end with an orthographic stage.

According to most models, children initially read in their native language by taking a logographic approach to reading (Ehri, 1997; Frith, 1985; Gough et al., 1992). That is, children learn to recognize words by forming connections between distinctive, visual features of a word and its meaning. Such features may be the shape of a word, a specific letter, or the word's length (Gough et al., 1992). For example, a child may recognize the word *dog* by remembering that it has an ascending vertical line close to the front or a tail at the end. Such cues are neither phonological nor alphabetic.

Most models propose that the next stage is characterized by phonological decoding, in which children use their knowledge of letter-sound correspondences to recognize new words (Ehri, 1997; Frith, 1985; Gough et al., 1992). Initially, children may use a partial alphabetic approach to reading, in which they use some phonetic cues to attack unfamiliar words (Ehri, 1997). At this time, children apply letter-sound correspondences to the consonants or the initial and final letters of a word and guess a plausible pronunciation of the word. However, as children gain greater mastery of the letter-sound correspondences, they use a full alphabetic approach to word reading, in which they apply grapheme-phoneme correspondences to each of the graphemes in the word (Ehri, 1997).

Finally, models of reading acquisition end with an orthographic, or consolidated stage in word reading (Ehri, 1997; Frith, 1985; Gough et al., 1992). In this stage, readers must have more comprehensive knowledge of multiletter patterns, morphemes, and their corresponding sounds. Children's knowledge of large-unit grapheme correspondences enables them to use analogies of known words to decode new words. For example, a child may use her knowledge of the pronunciation of the word *could* to pronounce the word *should*. Therefore, children must enter the orthographic stage to become proficient readers.

There is general consensus that reading acquisition within one's native language is an interactive process that depends on children's oral language skills in the progression through these stages (e.g., Adams, 1990; Catts, Fey, Zhang, & Tomblin, 1999; Snow, Burns, & Griffin, 1998). More specifically, these models have discussed the importance of phonological awareness, syntactic processing, and verbal working memory in the acquisition of reading skills (e.g., Adams, 1990; Catts et al., 1999; Siegel, 1993).

Phonological awareness, the ability to identify and manipulate phonemes, has proven to be one of the strongest predictors of subsequent reading development for native speakers of English (e.g., Adams, 1990; Cunningham & Stanovich, 1997; Perfetti, 1984) and other languages (Høien, Lundberg, Stanovich, & Bjaalid, 1995; McBride-Chang & Kail, 2002; Sprenger-Charolles, Siegel, Béchennec, & Sernieclaes, 2003). Indeed, phonological awareness has proven to be a more powerful predictor of the speed and efficiency of reading acquisition than measures of general cognitive ability (Share, Jorm, MacLean, & Matthews, 2002; Stanovich, Cunningham, & Cramer, 1984), perhaps because appreciation of the alphabetic principle depends on the ability to segment speech at the phonemic level (see Perfetti, 1984). Thus, strong phonological awareness may facilitate entry to the second, phonological stage of word reading, whereas poor phonological processing may impair the acquisition of the spelling-sound correspondences that underlie fluent word recognition (Goswami & Bryant, 1990; Tunmer & Hoover, 1992). Furthermore, successful phonological decoding, which depends on phonological awareness, enables children to acquire the orthographic representations that characterize the third, consolidated stage of word reading (Jorm & Share, 1983; Share, 1995).

Phonological Awareness and Second-Language Learners

Although the importance of phonological awareness in reading acquisition has been clearly established within one's native language, there is now a growing body of research examining the role of phonological awareness in reading acquisition when instruction is in a second language. Indeed, there is increasing evidence that phonological awareness transfers from children's first to second language (Bruck & Genesee, 1995; Cisero & Royer, 1995; Durgunoglu, Nagy, & Hancin-Bhatt, 1993; Geva & Siegel, 2000; Verhoeven, 1994).

However, although phonological awareness may transfer from one's first to second language, it is unclear if phonological awareness follows the same developmental path and contributes to reading acquisition in the same way for children learning to read in a second language. On the one hand, phonological awareness may develop later for children when instruction is in a second language. For example, Chiappe, Siegel, and Gottardo (2002) found that ESL children performed more poorly on measures of phonological awareness in English than native English speakers when they were in kindergarten. However, these differences were resolved by the time these children completed the first grade (Chiappe, Siegel, & Wade-Woolley, 2002). On the other hand, Campbell and Sais (1995) found that phonological awareness was accelerated for bilingual children when they were in kindergarten. Similarly, McBride-Chang and Kail (2002) found that bilingual children in Hong Kong were more accurate at syllable deletion in English than monolingual English-speaking U.S. children. Thus, the development of phonological awareness in bilingual children needs to be better understood.

Although the importance of phonological processing in reading acquisition is well established, two additional oral language skills have been found to be important for reading acquisition (e.g., Catts et al., 1999; Siegel, 1993): syntactic awareness and verbal memory. The former refers to the ability to understand the basic grammatical structure of the language. This skill appears to be critical for the fluent and efficient reading of text because fluent reading requires predicting words that come next in a sequence. Deficits in syntactic awareness have been reported for poor readers learning to read in English (e.g., Gottardo, Stanovich, & Siegel, 1996; Siegel & Ryan, 1988; Tunmer & Hoover, 1992) and other languages (e.g., Bentin, Deutsch, & Liberman, 1990; Breznitz & Leikin, 2000; Da Fontoura & Siegel, 1995; So & Siegel, 1997). Given the importance of syntactic processing in reading acquisition, children may experience difficulties in learning to read in a second language because lexical and syntactic processing may not transfer from their first to second languages (Verhoeven, 1994).

Similarly, individuals with reading disabilities experience significant difficulties with working memory while learning to read their native language, be it English (Brady, Shankweiler, & Mann, 1983; Chiappe, Hasher, & Siegel, 2000; Siegel & Ryan, 1988; Swanson & Sachse-Lee, 2001), Chinese (So & Siegel, 1997), French (Plaza, Cohen, & Chevrie-Muller, 2002), Korean (Song & Won, 1998), or Hebrew (Geva & Siegel, 2000). Deficits in working memory have been thought to result from difficulties in encoding adequate phonological representations (Brady, 1997). Because second-language learners experience a lack of fit between their phonological representations and the phonological structure of the language they are learning, they may show limited working memory performance in the second language, which might contribute to difficulties in reading acquisition.

Although poor readers have been found to show wide-ranging deficits on oral language tasks, it is less clear whether language deficits beyond the domain of phonology play a causal role in reading failure. For example, Shankweiler, Crain, Brady, and Macaruso (1992) have argued that deficits in phonological processing may impede the acquisition of other language skills, such as syntactic processing and vocabulary knowledge. Indeed, Gottardo et al. (1996) found that syntactic processing failed to predict reading performance independently of phonological sensitivity and working memory, thereby supporting the view that the development of syntactic skills may be limited by phonological processing. Similarly, there has been growing recognition of the importance of print exposure in developing language skills (e.g., Echols, West, Stanovich, & Zehr, 1996; Stanovich, 1993). Indeed, longitudinal and regression-based designs have shown that print exposure explains significant variance in children's growth in vocabulary, verbal fluency, and general knowledge even after controlling for age, phonological processing, and general cognitive ability (Echols et al., 1996; Stanovich, 1993). In other words, children with greater print exposure have more opportunities to expand their vocabularies, general knowledge, and oral language skills. Therefore, although deficits in oral language may be associated with reading disability, it is possible that they are a consequence rather than a cause of poor reading.

Study Purpose

The study addressed three main research questions. First, we asked if native English speakers and linguistically diverse children showed similar achievement and growth in reading and oral language skills in English through first and second grades. Second, we examined whether native English speakers (NSs) and English language learners (ELLs) progress through the same set of stages when learning to read, as reflected by their word reading errors. Finally, we wished to determine if the pattern of first-grade predictors of second-grade reading outcomes would be the same for NS and ELL children.

Method

Participants and Design

The participants were all the children enrolled in the first grade of a public school in metropolitan Toronto. Although 91 children participated in the first-grade assessments given in February and March, 17 were unavailable for testing in March and April of the second grade. Thus, a total of 74 children participated in the study. Of these children, 36 were NS. These children spoke English at home with their parents. Thirty-eight children reported that they spoke a language other than English at home and were classified as ELL. The main languages they spoke included Punjabi (26 children), Chinese (3), and Hindi (3). Additional languages spoken by one or two ELLs included Arabic, Farsi, Gujarati, Urdu, and Vietnamese. The children from both language groups lived in the same neighborhoods; they were predominantly middle class.

At both grades, we classified children as average or poor readers based on their performance on the reading subtest of the Wide Range Achievement Test—3 (WRAT-3; Wilkinson, 1995). Children with reading scores at or below the twenty-fifth percentile were labeled poor readers, and children who obtained reading scores at or above the thirtieth percentile were classified as average readers. In the first grade, six children were identified as poor readers (3 NS and 3 ELL children), and 68 were classified as average readers (33 NS and 35 ELL children). When children were in the second grade, we classified 10 as poor readers (6 NS and 4 ELL children) and 64 children as average readers (30 NS and 34 ELL). The incidence of poor readers was the same for children in both language groups in the first grade, $\chi^2(1, 74) < 1$, *ns*, and in the second grade, $\chi^2(1, 74) < 1$, *ns*. Because of the low incidence of poor readers, reading-group comparisons are not reported below.

Literacy Instruction

Teachers in this school used a balanced approach to literacy instruction. More specifically, although the relative emphasis on each component changed as children progressed through the primary grades, instruction in kindergarten through the second grade included systematic and explicit phonics instruction using Lloyd's (1993)

Phonics Handbook, word study, read alouds, shared and guided reading, and guidance in reading comprehension. Lloyd (1993) uses a multisensory approach to phonics instruction, in which children are taught an action to accompany each letter-sound correspondence in the context of a story. For example, children are told a story about a dog finding a snake when they are introduced to the letter *s*. Next, they are shown a sign (wiggling their hands like snakes) to accompany the sound /s/. Finally, children are encouraged to produce the sign and sound independently when they see the letter.

Measures: Word Reading

Wide Range Achievement Test—3. In both sessions, we assessed children's reading skills using the reading subtest of the Wide Range Achievement Test—3 (WRAT-3; Wilkinson, 1995). This test requires children to identify 15 uppercase letters and a set of words presented in a list of increasing difficulty. This task is discontinued when children make 10 consecutive errors. Both raw scores and percentile scores were recorded for this measure.

High-frequency words. In addition to the tan and blue forms of the reading subtest of the WRAT-3, we presented a set of 40 high-frequency words to children in both sessions. These words varied along the dimensions of regularity and consistency (see Coltheart & Leahy, 1992; Glushko, 1979). This set contained nine regular-consistent words, 14 words classified as regular-inconsistent, and 17 words classified as exception words. The regular-consistent words included *came*, *set*, *when*, *soon*, *game*, *like*, *deep*, *best*, and *feet*. The regular-inconsistent words were *five*, *now*, *but*, *gave*, *beard*, *days*, *home*, *food*, *moth*, *paid*, *that*, *lost*, *goes*, and *seen*. The exception words were *have*, *most*, *come*, *full*, *both*, *heard*, *shown*, *says*, *head*, *what*, *said*, *put*, *move*, *good*, *give*, and *four*. The word *does* was classified as an exception word to reflect its more common pronunciation, /dʌz/. However, its alternate pronunciation, /doz/, was also accepted as a correct response. Children's pronunciation of each word was recorded. This task had a maximum score of 40.

Pseudoword reading. We assessed children's skill at decoding unfamiliar words in both sessions using a pseudoword reading task. Children attempted to read 10 simple consonant-vowel-consonant (CVC) syllables composed of invariant consonants, and five CVC syllables that ended with an "e." The CVC pseudowords were *bav*, *dut*, *lod*, *tid*, *pov*, *mul*, *sep*, *lin*, *kef*, and *hap*. The CVCe pseudowords were *beve*, *nade*, *lope*, *mude*, and *tibe*. This task had a maximum score of 15.

Environmental print. When children were in the first grade, we assessed their experience with everyday print using an environmental print task. In this task, children attempted to name two sets of six stimuli. The stimuli were names of objects, signs, and local sports teams that were common in the environment and included McDonald's, Roots (a popular clothing chain in Canada), Nike, Toronto Raptors, Stop, and Toronto Maple Leafs. In both blocks, all six stimuli were presented. However, we presented two stimuli in each of three conditions. Thus, each stimulus was presented in two of the three conditions. In the first condition, the logo condition, stimuli were presented in their stylized print accompanied by their familiar logos. For example, Nike was presented in the familiar typeface with the familiar graphic swoosh. In the second condition, the stylized print condition, we presented stimuli in their familiar typeface but without the logo. For example, McDonald's appeared in its stylized print without the well-known golden arches. The third condition was the typeface condition, in which stimuli were presented in 20-point Century Gothic font. Stimuli were counterbalanced so that every stimulus appeared in each condition an equal number of times. The number of stimuli recognized in each condition (logos, stylized print, and typeface) was recorded. The maximum value for each of the three scores obtained from this task was 4.

Reading-Error Analysis

We also wished to determine if children from the two language groups used different strategies in word recognition, as revealed by their reading errors. Because many children showed ceiling effects in reading the experimental word list in the second grade, we analyzed only errors committed on the WRAT-3 for both grades.

Once a response had been scored as incorrect, it was identified by one of several mutually exclusive categories. The first and simplest error type was "no response," in which children either indicated that they did not know the target word or did not make any response at all. We calculated the proportion of errors that were no responses by dividing the number of no responses by the combined total of all errors. Thus, if a child missed 12 words but did not attempt four of those words, the proportion of no responses was $4 \div 12 = .33$.

The remaining types of errors reflect varying degrees of competence in the application of spelling-sound correspondences. Errors that resemble the correct pronunciation of the target word would reflect competence in the use of grapheme-phoneme correspondences. Alternately, errors that do not resemble the correct pronunciation of the target word would reflect difficulties in the application of spelling-sound correspondences.

The following types of errors reflected growing competence in the use of spelling-sound rules. The first type of error, "regularizations," reflected the overgeneralization of grapheme-phoneme correspondences (GPC) rules. Regularization errors were responses in which irregular words were given regular pronunciations because the child inappropriately applied GPC rules. Typically, the less common pronunciation of the vowel had been substituted with its most frequent pronunciation (e.g., *head* read as /hId/ or *move* read as /mov/). The "regular" pronunciation of each vowel was its most frequent pronunciation, based on the count by Berndt, Reggia, and Mitchum (1987). The second type of error that reflected competence in the application of grapheme-phoneme correspondences was the "-1" error, which occurred when the child's response deviated from the target pronunciation by a single phoneme. Although regularization errors qualified as -1 errors, they were excluded from the -1 category. Because the -1 category embraced several types of errors, this category was divided into four subcategories: (*a*) "-1 insertions," in which a single phoneme was added to the pronunciation of the target word (e.g., *four* read as *floor*); (*b*) "-1 deletions," in which a single phoneme in the target word was not pronounced (e.g., *heard* read as *her*); (*c*) "-1 vowel," in which the pronunciation of the target vowel was substituted with the pronunciation of a different vowel (e.g., *came* read as *come*); and (*d*) "-1 consonant," in which one of the target consonants was substituted with the pronunciation of a different consonant (e.g., *book* read as *look*). Thus, we used the regularization and -1 errors to assess growing competence in the application of spelling-sound correspondences.

Wild errors were responses that were neither regularization errors nor -1 errors. The wild error category was divided into three subcategories: (*a*) "semantic wild" errors, in which the response shared little visual or phonological overlap with the target word but was semantically related to the target word (e.g., *rabbit* read as *bunny*); (*b*) "wild first letter" errors, in which the first phoneme of the target word was correct but was followed by a minimum of two errors (e.g., *jar* read as *jump*); and (*c*) "other wild," in which the response shared little visual or phonological overlap with the target word and was not semantically related to the target word (e.g., *like* read as *kite*). Other wild errors could be considered guesses. Thus, wild errors reflected poor mastery of grapheme-phoneme correspondences.

Children's errors were classified and the mean percentages of regularization, -1, and wild errors were calculated in the following manner: For each type of error, the number of errors was divided by the total number of incorrect responses (total errors minus no responses). Thus, if two out of a total of six incorrect responses were regularization errors, the percentage of regularization errors would be $2 \div 6 = .33$. The proportion of each type of error was calculated for errors produced on the WRAT-3 when children were in the first and second grades.

Phonological processing. All children were administered multiple measures of phonological processing. We administered these tasks in both sessions, unless indicated otherwise.

Sound mimicry: First, we assessed children's skill at recognizing and reproducing sounds in oral language using the sound mimicry subtest of the GFW Sound Symbol Test (Goldman, Fristoe, & Woodcock, 1974). In this task, children repeated pseudowords of increasing difficulty that the experimenter had read to them. Pseudowords ranged in difficulty from VC syllables (e.g., *ab* and *id*) to polysyllabic pseudowords (e.g., *depnoniel* and *bafmotbem*). Once a child produced five consecutive errors, the task was discontinued. Both raw scores and percentile scores were dependent measures.

Rhyme detection: The rhyme detection task from the Phonological Awareness Test (Muter, Hulme, & Snowling, 1997) was administered when children were in first and second grade. In this task, children were asked which of three words (e.g., *fish*, *gun*, *hat*) rhymed with the target word (e.g., *cat*). Pictures of the target word and the three selections were presented to reduce the memory load involved in this task. There were three practice trials in which the child received corrective feedback, followed by 10 test trials with no feedback. The maximum score was 10.

Rhyme production: This task was administered to children in both sessions. In this task, children were asked to generate rhyming words for the target words, *day* and *bell*. They were given 30 seconds to generate rhymes for each target word. The score was the total number of unique words and nonwords that rhymed with the target words.

Syllable and phoneme identification tasks: Relevant tasks from the Phonological Awareness Test were also administered in both sessions. In these tasks, children were required to complete words. In the syllable identification task, the examiner said, "Here is a picture of a rabbit. I'm going to say the first part of the word. Can you finish it for me? Here is a ra . . . . " Corrective feedback was provided for the two practice trials but not for the eight test trials without feedback. This task was followed immediately by the phoneme identification task. This task followed the same procedure as the syllable identification task, except that children were required to produce the final phoneme of words. Corrective feedback was given in the three practice trials but not in the eight subsequent test trials. For both the syllable and phoneme identification tasks, the examiner showed children pictures of the target words to reduce the memory load. The maximum scores of both syllable and phoneme identification were 8.

Phoneme deletion: We assessed children's skill at deleting phonemes from words using two tasks. The first task, the phoneme deletion task from the Phonological Awareness test, was administered in both sessions. In this task, children were first required to delete the initial phoneme of words and then to delete the final phonemes of words. In both conditions, children were given three practice trials in which corrective feedback was provided, and eight test trials without feedback. For all trials, children were shown pictures of the target words to minimize the memory load. The maximum score for this task was 16.

The second measure assessing phoneme deletion was the phoneme deletion and substitution task that Vandervelden and Siegel (1995) used. Items selected from levels F, G, and H of the Auditory-Motor Skills Training (Rosner, 1973) were administered to children in both sessions. In this task, children attempted either to delete a phoneme from a word or substitute the target phoneme with a different phoneme. For example, when children deleted phonemes from words, the examiner said: "say /bat/. Say it again but don't say /b/." When children substituted phonemes, the examiner said: "Say /bat/. Say it again, but instead of /b/ say /m/." There were six trials when the target phoneme was in the initial position of the word, six trials when the target phoneme was in the final position of the word, and six trials when the target phoneme was part of a blend. This task had a maximum score of 18.

Rapid automatized naming (RAN): We measured phonological recoding in lexical access, or word retrieval, in both sessions using a variation of the rapid automatized naming task (RAN; Denckla & Rudel, 1976). In this task, the child named 40 items on a chart with eight rows and five columns. The chart consisted of five stimuli repeated eight times, which were line drawings of a tree, a chair, a bird, a pear, and a car. To ensure that all children knew the target words, the examiner presented a practice chart of the five items immediately before the chart of 40 items was presented. If a child could not name one of the five practice items, the experimenter provided its name and asked the child to name the five practice items a second time. If the child was unable to readily produce the names of the five practice items after the prompting, the test chart of 40 items was not presented to the child and the RAN task was not administered. The score used was the children's naming rate, which was calculated by dividing the total number of items named (40) by the time taken to complete the chart in seconds.

Oral language proficiency. We were also interested in examining language skills thought to contribute to reading development that extend beyond the phonological core. To that end, we administered measures of syntactic awareness and verbal working memory.

Syntactic awareness: We used two tasks to assess children's knowledge of English grammar. The first, the syntactic error judgment task (Gottardo et al., 1996), was administered in both sessions. In this task, the experimenter read sentences to the child that either contained grammatical errors or were grammatically correct. Errors included the use of an inappropriate function word (e.g., They went *at* school), the incorrect order of phrases within the sentence (e.g., Clapped his hands Mark), words ordered incorrectly within phrases (e.g., The *bear brown* growled), lack of subject-predicate agreement (e.g., The *boy run* quickly), and the use of an incorrect copula verb (e.g., *I are* happy). After listening to each sentence, children indicated whether it was right or wrong. In the first grade, 35 sentences were presented and 25 contained errors. In the second grade, 20 sentences were presented and 14 contained grammatical errors. The score used was the percentage of correct responses.

When children were in the first grade, we also assessed their syntactic awareness using an oral cloze task developed by Willows and Ryan (1981) and Siegel and Ryan (1988). In the oral cloze task, sentences were read to the children, who attempted to provide the missing word. Examples include "Jane ______ her sister ran up the hill" and "Jim set the lamp on the desk so he could ______." This task had a maximum score of 12.

Verbal working memory: In both sessions, we used Siegel and Ryan's (1988) adaptation of the listening span task that Daneman and Carpenter (1980) developed to assess children's verbal working memory. In this task, the experimenter read to children sentences that were missing their final words. Children supplied the missing word and attempted to repeat all the set's missing words on completion of the set. Sets contained two, three, or four sentences. Each set size, or level, contained three trials. To reduce difficulties in word retrieval, the sentences were selected so that the final word was virtually predetermined. None of the children experienced difficulties providing the final word. Examples of sentences were, "In a baseball game, the pitcher throws the ______"; "On my two hands, I have ten ______." Participants then attempted to repeat the two words that they had selected, in this case, *ball* and *fingers*. The task was discontinued when the child failed all three items at a given level. We used the number of perfectly recalled sets in which the final words were reported in order as the dependent variable. The maximum possible score was 12.

Procedure

At both grade levels, trained graduate students administered the tests to children in individual sessions in a quiet room at the school. All instructions were presented in English.

Results

Performance on Reading Measures

Table 1 summarizes children's performance on the reading measures for each session. A pair of multivariate analyses of variance (MANOVAs) on the six first-grade reading measures (WRAT-3 reading raw scores, high-frequency words, pseudoword reading, and each condition of the environmental print task: logos, labels only, and typeface) and the three second-grade reading measures (WRAT-3 reading raw scores, high-frequency words, pseudoword reading) were calculated to determine whether language background (ELL or NS) influenced performance on the literacy measures. Although there was a significant effect of language group in the first grade, $F(5, 68) = 2.33$, $p < .05$, partial $\eta^2 = 0.17$, the groups did not differ in the second grade, $F(3, 70) < 1$, *ns*, partial $\eta^2 = 0.010$. A subsequent series of analyses of variance (ANOVAs) using the Bonferroni adjustment for multiple comparisons revealed significant differences in the first grade between the language groups only for the environmental print task's logos condition, $F(1, 72) = 6.67$, $p < .05$, partial $\eta^2 = .085$, and the labels condition, $F(1, 72) = 5.48$, $p < .05$, partial $\eta^2 = .071$. None of the other reading measures revealed significant effects of language group. Thus, the only reading measure that discriminated between ELL and NS children was the one that tapped children's knowledge of popular culture. ELL and NS children were not significantly different on any other reading measure in first grade and on no measure in second grade.

Next, we were interested in determining whether children from different language backgrounds showed comparable growth in literacy between the first and second grades. We calculated a series of 2 (language group) $\times$ 2 (grade) repeated-measures ANOVAs, with grade as the repeated measure, for the three literacy measures administered at both grades. Overall, children showed significant growth in literacy between first and second grade in WRAT-3 reading raw scores, $F(1, 72) = 263.18$, $p < .001$, partial $\eta^2 = .79$; reading the high-frequency words, $F(1, 72) = 38.03$, $p < .001$, partial $\eta^2 = .35$; and pseudoword reading, $F(1, 72) = 31.80$, $p < .001$, partial $\eta^2 = .31$. Neither the main effect of language group nor the interaction between language group and session was significant for any of the reading measures, indicating that ELL and NS children showed comparable performance and growth in word recognition and word attack between first and second grades.

The strategies children used when they read, as revealed by their errors on the WRAT-3, are presented in Table 2. Overall, children produced a greater proportion of no response errors when they were in the first grade, $F(1, 72) = 61.27$, $p < .001$, partial $\eta^2 = .46$. The significant main effect of language group, $F(1, 72) = 5.63$, $p < .05$, partial $\eta^2 = .073$, indicated that ELL children were more likely to attempt pronunciations for unfamiliar words. No other effects were significant.

TABLE 1. Means and Standard Deviations of First- and Second-Grade Literacy Measures, by Grade and Language Group

	First Grade		Second Grade	
Measure	NS	ELL	NS	ELL
WRAT-3:				
Raw score:				
Mean	24.39	23.42	29.03	28.61
SD	5.08	4.00	4.35	3.71
Percentile:				
Mean	68.56	67.00	60.44	58.82
SD	26.50	24.41	25.91	24.07
High-frequency words (max. = 40):				
Mean	26.14	25.11	33.58	33.97
SD	12.02	9.80	8.58	7.51
Pseudoword reading (max. = 15):				
Mean	6.69	6.87	9.69	9.08
SD	4.29	4.15	3.45	3.82
Environmental print (max. = 4):				
Logos:				
Mean	3.03	2.32		
SD	1.06	1.30		
Labels:				
Mean	2.81	2.11		
SD	1.24	1.33		
Typeface:				
Mean	2.42	1.87		
SD	1.44	1.65		

The mean percentage of errors assumed to reflect competence in the application of grapheme-phoneme correspondence rules, regularization and -1 errors, is presented in the top portion of Table 2. A pair of MANOVAs using the mean proportion of errors thought to reflect greater mastery of the grapheme-phoneme correspondence rules (regularization, -1 insertion, -1 deletion, -1 vowel, and -1 consonant) did not reveal significant differences between NS and ELL children in the first grade, $F(5, 60) = 1.76$, *ns*, or the second grade, $F(5, 40) = 1.29$, *ns*.

Next, we wished to determine if children became more skilled in using GPC rules, as revealed by the proportion of regularization and -1 errors, between the first and second grade. To do so, we calculated a series of repeated-measures ANOVAs. Overall, children's tendency to produce -1 insertion errors increased between the first and second grade, $F(1, 40) = 3.28$, $p < .05$, partial $\eta^2 = .11$, whereas the tendency to produce -1 vowel errors decreased between these grades, $F(1, 40) = 11.55$, $p < .001$, partial $\eta^2 = .29$. Thus, although children were more likely to insert an additional phoneme into the target words, they were less likely to confuse the vowels as they got older. There was a significant main effect of language group for the -1 errors (combined), indicating that ELL children's errors were more likely to deviate from the target word by a single phoneme. We also found that the interactions between grade and language group were significant for -1 errors (combined), $F(1, 40) = 4.39$, $p < .05$, partial $\eta^2 = .14$, and -1 consonants, $F(1, 40) = 3.88$, $p < .04$, partial $\eta^2 = .12$. In both cases, NS children became less likely to produce these errors between first and second grade, whereas the proportion of these errors increased for ELL children. Therefore, ELL children were more likely to apply GPC rules in pronouncing unfamiliar words. Furthermore, the tendency to apply these rules to unfamiliar words increased

TABLE 2. Means and Standard Deviations of Percentage of Error Types on WRAT Reading Subtest, by Grade and Language Group

	First Grade		Second Grade	
Error	NS	ELL	NS	ELL
No response:				
Mean	68.67	61.74	40.74	21.30
SD	24.83	24.46	39.33	30.81
Regularization:				
Mean	10.08	4.25	11.31	4.48
SD	26.60	9.91	23.86	8.50
−1 errors (combined):				
Mean	41.25	39.76	21.75	52.65
SD	30.65	24.89	20.73	40.80
−1 insertion:				
Mean	.40	4.34	4.19	6.95
SD	1.01	10.19	6.29	9.28
−1 deletion:				
Mean	3.66	2.65	4.19	22.31
SD	9.62	6.96	5.63	26.73
−1 vowel:				
Mean	27.04	27.35	10.27	13.62
SD	35.39	23.76	12.73	11.35
−1 consonant:				
Mean	9.97	3.09	5.62	8.39
SD	20.78	9.02	10.24	10.09
Wild errors (combined):				
Mean	52.46	61.80	43.03	44.91
SD	33.15	31.91	29.51	21.98
Semantic:				
Mean	0	.35	0	0
SD	0	2.08	0	0
Wild first letter:				
Mean	49.68	53.83	39.92	29.90
SD	30.98	32.51	26.58	20.23
Other:				
Mean	2.78	7.62	5.89	5.33
SD	6.54	16.59	10.07	7.83

between first and second grade for ELL children at the same time it decreased for NS children.

The mean percentage of wild errors is presented in the lower portion of Table 2. Wild errors are thought to reflect poor mastery of grapheme-phoneme correspondence rules and the use of strategies such as guessing. A pair of MANOVAs on the three types of wild errors (semantic, first letter, and other) did not reveal differences between NS and ELL children in the first grade, $F(3, 62) = 1.27$, *ns*, or the second grade, $F(3, 40) < 1$, *ns*.

Next, we wished to determine if children's tendency to guess the pronunciation of unfamiliar words decreased. To do so, we calculated a series of repeated-measures ANOVAs. Overall, the proportion of wild (combined) errors decreased between first and second grade, $F(1, 42) = 3.04$, $p < .05$, partial $\eta^2 = .097$. However, no other effects were significant. Thus, the global measure of guessing, wild (combined) errors, suggested that children from both language groups were less likely to rely on unreliable strategies like guessing as they became more skilled in reading.

Children's performance on the measures of phonological processing is presented in Table 3. A pair of MANOVAs on the eight phonological measures used in the first and second grades (GFW sound mimicry raw scores, rhyme detection, rhyme production,

Table 3. Means and Standard Deviations on Measures of Phonological Processing, by Grade and Language Group

Measures	First Grade NS	First Grade ELL	Second Grade NS	Second Grade ELL
GFW sound mimicry:				
Raw score (max. = 55):				
Mean	48.81	48.55	52.00	50.74
SD	6.06	5.19	3.10	2.48
Percentile:				
Mean	69.58	68.37	80.26	72.08
SD	28.41	26.93	21.38	19.67
Rhyme detection (max. 10):				
Mean	8.33	7.39	9.50	9.29
SD	2.80	3.07	.81	1.52
Rhyme production (max. 10):				
Mean	7.31	5.89	10.08	11.08
SD	3.65	4.07	5.06	5.94
Syllable identification (max. 8):				
Mean	6.00	6.11	6.44	6.61
SD	1.10	1.31	1.23	1.46
Phoneme identification (max. 8):				
Mean	6.78	6.37	6.86	6.95
SD	2.38	1.91	1.62	1.68
Phoneme deletion (max. 16):				
Mean	12.17	11.92	14.94	14.95
SD	4.87	5.19	1.94	1.75
Phoneme deletion and substitution (max. 18):				
Mean	9.94	9.47	12.86	12.50
SD	5.38	5.27	4.12	3.96
RAN (items/second):				
Mean	.84	.89	.95	1.04
SD	.19	.19	.17	.19

syllable identification, phoneme identification, phoneme deletion, phoneme deletion and substitution, and RAN rate) were calculated. However, there were no significant effects of language group in the first grade, $F(8, 65) < 1$, *ns*, partial $\eta^2 = .10$, or second grade, $F(7, 66) = 1.51$, partial $\eta^2 = .14$.

Next, we used a series of 2 (grade) × 2 (language group) repeated-measures ANOVAs, with grade as the repeated measure, for each of the phonological processing tasks to determine whether children from different language backgrounds showed comparable growth in processing English phonology. Overall, children showed significant growth in phonological processing in English between first and second grade. More specifically, the main effect of grade was significant for GFW raw scores, $F(1, 72) = 17.36$, $p < .001$, partial $\eta^2 = .19$; GFW percentile scores, $F(1, 72) = 4.74$, $p < .05$, partial $\eta^2 = .063$; rhyme detection, $F(1, 72) = 23.87$, $p < .001$, partial $\eta^2 = .25$; rhyme production, $F(1, 72) = 45.81$, $p < .001$, partial $\eta^2 = .39$; syllable identification, $F(1, 72) = 5.07$, $p < .05$, partial $\eta^2 = .066$; phoneme deletion, $F(1, 72) = 32.18$, $p < .001$, partial $\eta^2 = .31$; phoneme deletion and substitution, $F(1, 44) = 63.22$, $p < .001$, partial $\eta^2 = 59$; and RAN, $F(1, 72) = 36.09$, $p < .001$, partial $\eta^2 = .33$. The interaction between language group and grade was significant for the task that had the greatest demands on oral language proficiency, rhyme production, $F(1, 72) = 4.19$, $p < .05$, partial $\eta^2 = .055$. No other effects were significant.

Children's performance on the language measures is summarized in Table 4. A pair of MANOVAs on the three language measures (oral cloze, syntactic error judgment, and listening span) administered in first grade, and on the two language measures

Table 4. Means and Standard Deviations on Measures, by Grade and Language Group

	First Grade		Second Grade	
	NS	ELL	NS	ELL
Oral cloze (max. 12):				
Mean	5.44	4.11		
SD	2.81	2.97		
Syntactic error judgment (% correct):				
Mean	57.14	56.99	74.72	72.89
SD	15.47	11.15	10.82	10.82
Working memory (max. 12):				
Mean	1.69	2.05	3.08	3.42
SD	1.28	1.31	1.56	1.41

(syntactic error judgment and listening span) administered in second grade, were calculated. Significant effects of language group were revealed when children were in the first grade, $F(1, 72) = 3.29$, $p < .05$, partial $\eta^2 = .13$, but not in the second grade, $F(1, 71) < 1$, *ns*. A subsequent series of ANOVAs using Bonferroni adjustments for multiple comparisons revealed significant differences between the language groups in oral cloze in the first grade, $F(1, 71) = 4.00$, $p < .05$, partial $\eta^2 = .053$. No other effects were significant.

To determine whether children from different language backgrounds showed comparable growth in oral cloze and listening span, we calculated a pair of 2 (language group) $\times$ 2 (session) repeated-measures ANOVAs. Both groups of children showed significant growth in syntactic error judgment, $F(1, 70) = 78.37$, partial $\eta^2 = .52$, and in the listening span, $F(1, 71) = 55.97$, $p < .001$, partial $\eta^2 = .44$. However, no other effects were significant.

Prediction of Reading Skill in the Second Grade

Three regression analyses were conducted to select the first-grade variables that best predicted children's second-grade reading performance as measured by WRAT-3 reading raw scores. In each analysis we used stepwise analysis to select the first-grade variables that were significant predictors of second-grade reading performance. Next, one contrast comparing NS and ELL children was forced into the regression equation as a final step. The coding for the contrast was +1 for ELL children and 0 for NS children. The results from the three regression analyses were convergent.

In the first analysis, all of the first-grade variables, with the exception of the word reading measures (WRAT-3 reading and the high-frequency words), were entered into the regression equation to determine which variables predicted second-grade reading performance. Table 5 shows that four of the first-grade variables explained significant variance in WRAT-3 reading in the second grade: the typeface condition of the environmental print task ($R^2 = .450$), pseudoword reading (additional variance explained = .073), oral cloze (additional variance explained = .029), and RAN rate (additional variance explained = .023). The planned contrast indicated that English learner status did not account for additional variance in WRAT-3 reading performance in the second grade.

Because close to half the variance in second-grade reading was explained by first-grade reading (as measured by the typeface condition of the environmental print task), we used the second stepwise regression analysis to determine which variables were salient predictors when all three conditions of the environmental print as well as WRAT-3 and high-frequency words task were excluded from the set of predictors. The potential predictor variables entered into the equation were pseudoword read-

TABLE 5. Stepwise Regression Analysis of First-Grade Variables Predicting Children's WRAT-3 Reading Raw Scores in the Second Grade

Predictor Variable	Standardized Beta	R^2	ΔR^2	*F*-ratio	Probability
All first-grade variables:					
Including reading measures:					
1. EP—typeface	.402	.450	.450	58.00	<.001
2. Pseudoword reading	.299	.523	.073	10.79	<.01
3. Oral cloze	.189	.552	.029	4.38	<.05
4. RAN rate	.160	.578	.023	4.31	<.05
NS vs. ELL	.033			<1	*ns*
Excluding reading measures:					
1. Pseudoword reading	.418	.385	.385	44.54	<.001
2. Phoneme deletion and substitution	.336	.459	.073	9.46	<.01
NS vs. ELL	−.058			<1	*ns*
All first-grade reading errors:					
1. −1 deletions (%)	.299	.095	.095	6.71	<.01
2. Regularizations (%)	.292	.180	.085	6.57	<.05
NS vs. ELL	−.065			<1	*ns*

ing, all measures of phonological processing, and all of the oral language measures. The results are summarized in the middle part of Table 5. Pseudoword reading in the first grade explained 38.5% of the variance in second-grade WRAT-3 reading performance. Phoneme deletion and substitution accounted for an additional 7.3% of the variance. The planned contrast was not significant, indicating that children's language background did not explain additional variance in WRAT-3 reading performance.

We calculated the third regression to determine if the strategies that children used in first grade, as revealed by their errors, predicted their WRAT-3 reading performance in second grade. The proportions of no response, regularization, and each type of −1 and wild errors were entered as predictor variables for stepwise selection, and the final step remained the planned contrast comparing NS and ELL children. The results are summarized in the bottom part of Table 5. The −1 deletions explained 9.5% of the variance in second-grade reading, and regularization errors explained an additional 8.5%. Recall, −1 deletions, and regularization errors were thought to reflect growing competence in the use of spelling-sound correspondence rules. Thus, skill in the use of grapheme-phoneme correspondences explained variance in word recognition. Once again, the planned contrast (NS vs. ELL) did not explain additional variance in second-grade reading skill.

Discussion

The first question motivating this research was whether basic literacy-related skills in English developed in the same way for NS and ELL children. When considering basic literacy skills, we found that the performance profiles of ELL children were similar to native English speakers. Indeed, ELL and NS children showed comparable performance and growth in reading words and pseudowords. Furthermore, reading difficulties in English occurred with approximately the same frequency for native and non-native speakers of English. Although NS children were more successful than ELL children at identifying logos from the environment, children from both language groups performed equally well when the logos were removed and the environmental print task became a decoding task.

We also found support for the view that phonological awareness and phonological processing in English develop in a similar fashion for native and non-native English speakers. ELL children showed comparable performance and growth to NS children on all measures of phonological processing in both first and second grade. Only one phonological measure, rhyme production, revealed a significant interaction between grade and language group. This interaction would be consistent with the view that bilingualism accelerates the development of phonological awareness (e.g., Campbell & Sais, 1995). However, the current findings are more consistent with the view that phonological awareness follows the same developmental trajectory for NS and ELL children in the first and second grades for the following reason: The interaction was revealed only by the phonological measure that had the greatest demands on oral language proficiency—generating words and nonwords. Therefore, the finding that ELL children showed greater growth in rhyme production than NS children may reflect growth in ELL children's oral language proficiency rather than accelerated development of phonological awareness.

There was some evidence that children's language backgrounds influenced their proficiency in English. Native English speakers obtained higher scores in oral cloze than ELL children. This finding is consistent with the oral language difficulties revealed by other samples of ELL children (e.g., Geva, Yaghoub-Zadeh, & Schuster, 2000; Lesaux & Siegel, 2003; Swanson, Sáez, Gerber, & Leafstedt, 2004). Although children from both language groups received comparable scores in the syntactic error judgment and working memory tasks, the null findings may reveal floor effects for NS and ELL children when they were in the first grade. Indeed, children's scores were not better than chance on the syntactic error judgment task in first grade.

The second issue concerns the investigation of whether native English speakers and linguistically diverse children use the same strategies in word reading. There were similar performance profiles for the ELL and NS children with respect to word recognition errors. For example, as children from both language groups progressed from first to second grade, their reliance on the use of grapheme-phoneme correspondences when reading unfamiliar words increased, as reflected by a decrease in the proportions of no response and wild (combined) errors and an increase in -1 insertion errors. There was also an overall reduction in the proportion of -1 vowel errors, suggesting that children were less likely to confuse the vowels. In fact, approximately a quarter of the mispronunciations in the first grade were vowel confusions, whereas approximately 10% of the mispronunciations in the second grade revealed confusion among vowels.

However, there were a few notable differences between the language groups. ELL children were more likely to attempt to read unfamiliar words than NS children. Furthermore, ELL children were more likely to use grapheme-phoneme correspondence rules in their attempts to read unfamiliar words, as revealed by the -1 (combined) errors. Therefore, although children from both language groups tended to show similar patterns of development in their use of reading strategies, ELL children were more likely to apply grapheme-phoneme correspondences when attempting to read unfamiliar words.

Finally, we wished to determine if the same cognitive and linguistic processes contributed to reading development in English for children from diverse language backgrounds. The key finding was that language group membership did not predict second-grade reading performance, suggesting that the same cognitive and linguistic processes underlie word-reading proficiency for children from diverse language backgrounds. Indeed, children's decoding skills in the first grade (as measured by pseudoword reading and the typeface condition of the environmental print task) accounted for half the variance in second-grade reading. This finding is consistent with the view that early reading achievement predicts reading performance in later grades (e.g., Cunningham & Stanovich, 1997; Juel, 1988). Syntactic awareness and word retrieval (as measured by oral cloze and RAN) were important predictors of second-grade reading achievement for children from both language groups after statistically accounting for first-grade reading skill. However, when all the first-grade measures of real-word reading had been excluded from the analyses, pseudoword reading and phonemic awareness (as measured by phoneme deletion and substitution) were the two predictors of reading performance for all children. Finally, the same reading errors NS and ELL children made in the first grade predicted their reading performance in second grade. Indeed, reading errors that reflected greater mastery of grapheme-phoneme correspondence rules (e.g., -1 deletions and regularization errors) in the first grade explained significant variance in word-reading skill in the second grade for all children. This finding supports the view that early mastery of grapheme-phoneme correspondences enables children to make greater progress in word reading (Share, 1995). Once again, the contrast between NS and ELL children was not significant. Thus, the same component skills and reading strategies are important for developing word-reading skills for middle-class children, regardless of their home language.

Although our findings provide further evidence that limited English proficiency need not interfere with the acquisition of word-reading skills, we cannot extend these conclusions to reading comprehension because we did not measure it.

In summary, ELL children from middle-class backgrounds showed similar growth and achievement as native English speakers in word reading and phonological processing. ELL children also tended to use the same strategies to decode unfamiliar words, suggesting that the stages proposed for word-reading development can be generalized to children learning to read in a second language. Furthermore, the same underlying skills and reading strategies were strongly related to reading acquisition in English for children from both language groups.

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