

Predictors of Reading and Spelling Abilities in First- and Second-Language Learners

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This study examined the basic literacy skills and related processes of 1st- through 4th-grade children speaking English as a 1st language (L1) and English as a 2nd language (ESL). The performances of the L1 and ESL children on phonological awareness, word and pseudoword reading, and word and pseudoword spelling tasks were highly similar. The ESL children were at an advantage with regard to lexical access but performed more poorly on verbal working memory and syntactic awareness tasks. The results suggest that the main processes underlying L1 children's basic reading ability in Grades 1 and 2, namely phonological awareness and lexical access, are of equal importance for ESL children. Phonological awareness remained the strongest predictor of word reading ability for L1 and ESL children in Grades 3 and 4. However, the processes involved in L1 and ESL word reading and spelling appeared to vary at other points. Verbal working memory and syntactic awareness were found to be of importance for the word reading and spelling abilities of L1 children but not for ESL children. Lexical access was found to be of more importance for ESL children.

Keywords: predictors of literacy, cognitive processes, ESL reading and spelling ability, second language learners

Children attending schools in which the instructional language is different from their native language are faced with the challenge of mastering academic skills in a language that they have yet to fully acquire. Among the academic skills that they must master are crucial reading and spelling abilities. Comparative studies of the development of literacy among first- (L1) and second-language (L2) learners have shown largely equal skills with regard to word recognition and pseudoword reading (e.g., Chiappe & Siegel, 1999; Verhoeven, 1990, 2000; D. A. Wagner, Spratt, & Ezzaki, 1989) and with regard to word spelling and pseudoword spelling (Lesaux & Siegel, 2003; Share & Stanovich, 1995; Wade-Woolley & Siegel, 1997). In some studies, an initially lower reading performance on the part of L2 learners relative to L1 learners has been found to recede after a longer period of reading instruction. When Verhoeven (1990) compared Dutch and Turkish children's Dutch word recognition abilities following 5, 10, and 20 months of reading instruction, for instance, the Dutch children showed a better overall performance following 5 and 10 months of reading instruction but no significant differences from the Turkish children following 20 months of reading instruction. Another example of such diminishing differences can be found in a longitudinal study

conducted in Morocco by D. A. Wagner et al. When the Arabic literacy of Arabic- and Berber-speaking children in Grades 1, 3, and 5 was examined, the Arabic-speaking children in Grade 1 performed significantly better on word reading measures than the Berber-speaking children. In Grades 3 and 5, however, the differences had receded and were no longer significant. It thus appears that the decoding and word recognition skills of L2 learners, despite these children's limited language proficiency, are often equal to those of L1 learners in the long run. The question in the present study, then, was whether the processes that are known to underlie the reading and spelling abilities of L1 learners are of equal importance for the reading and spelling abilities of L2 learners.

Although a number of well-known predictors of reading and spelling abilities exist, the present study focused on a select few predictors—namely phonological awareness, lexical access, syntactic awareness, and verbal working memory—and examined their relation to word reading and spelling abilities in children from Grades 1, 2, 3, and 4. The relations between these variables and literacy development are well established and, in studies comparing L1 and L2 children's performance, poorer performance on measures of lexical access, syntactic awareness, and working memory, but equal abilities for reading and spelling, have often been found for L2 children (see Siegel, 2002). Most studies that have examined the development of literacy skills and literacy-related skills in L2 learners have focused on young children in kindergarten, Grade 1, and Grade 2 (e.g., Chiappe, Siegel, & Wade-Woolley, 2002; Lesaux & Siegel, 2003; Verhoeven, 2000). The question was whether the processes underlying these select variables possibly relate differently to the development of literacy in young and slightly older L1 and L2 learners. The results of studies in which phonological awareness, lexical access, syntactic awareness, and/or verbal working memory have been considered

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in relation to the reading and spelling abilities of L1 and L2 learners are discussed in turn here.

Phonological awareness plays an important role in reading and spelling development. Phonological awareness refers to the ability to understand the sound structure of a language and includes the ability to segment speech into phonemes and the abilities to detect and manipulate phonemes. Numerous studies have demonstrated the influence and predictive value of phonological awareness on reading and spelling abilities (e.g., Bryant, Maclean, Bradley, & Crossland, 1990; Høien, Lundberg, Stanovich, & Bjaalid, 1995; Stanovich, 1988; Vandervelden & Siegel, 1995; R. K. Wagner, Torgesen, & Rashotte, 1994). Phonological awareness has been found to predict the reading skills of children learning to read in either a first language or a second language (e.g., Cormier & Kelson, 2000; Stuart, 1999). For instance, Chiappe and Siegel (1999) compared first-grade children from English- and Punjabi-speaking homes in Canada on measures of phonological awareness and reading skill. Phonological awareness did not discriminate between the native and nonnative speakers of English, and phonological awareness shared an important relation with reading skill for both groups of children.

A number of studies have shown phonological awareness skills to transfer from one language to another (Cisero & Royer, 1995; Comeau, Cormier, Grandmaison, & Lacroix, 1999; Durgunoğlu, Nagy, & Hancin-Bhatt, 1993; Lindsey, Manis, & Bailey, 2003). In a study of Spanish-speaking first-grade students, for example, Durgunoğlu et al. showed children with high levels of phonological awareness in Spanish (L1) to be more likely than other children to be able to read English words and pseudowords. The possible transfer of phonological awareness between languages may thus constitute an advantage for L2 learners. There is evidence that children who are exposed to more than one phonological system, moreover, have heightened levels of phonological awareness, even in the early stages of L2 acquisition (e.g., Bruck & Genesee, 1995; Campbell & Sais, 1995). Campbell and Sais found bilingual Italian-English kindergarten children to have accelerated phonological awareness when compared to monolingual English children. However, others have found weaker phonological awareness in young L2 learners. Verhoeven (2000), for example, found poorer phonemic segmentation skills in Grade 1 minority children when compared to Grade 1 nonminority (i.e., native Dutch-speaking) children. The differences in the phonological awareness of L1 and L2 children might depend on the type of task or grade, but different outcomes have still been found after type of phonological awareness task and grade have been taken into account. For example, Chiappe, Siegel, and Wade-Woolley (2002) found no differences in the performances of L1 and English as a second language (ESL) kindergarten children on a pseudoword repetition task. In contrast, Lesaux and Siegel (2003) reported that ESL kindergarten children performed more poorly on a pseudoword repetition task. Neither Chiappe, Siegel, and Wade-Woolley nor Lesaux and Siegel found any differences in the kindergarten performance of L1 versus ESL children on a phoneme detection task. In contrast, Campbell and Sais found L2 kindergartners to perform better than L1 kindergartners in an earlier study using such a task. Similarly conflicting findings have been reported for Grades 1 and 2. Wade-Woolley and Siegel (1997), for example, found poorer performance on a phoneme deletion task in Grade 2 for ESL children when compared to L1

children, whereas Lesaux and Siegel found no such differences between L1 and ESL children on a similar task in Grade 2. In other words, it is not at all clear if being educated in a second language brings certain advantages or disadvantages for the development of phonological awareness in the second language. The contradictory findings may certainly relate to the home language of the L2 children, the language of instruction, or the particular combination of such.

Lexical access, or the ability to efficiently access lexical information, is highly related to reading skill (e.g., Compton, 2003; De Jong & Van der Leij, 1999; Kirby, Parrila, & Pfeiffer, 2003; Lindsey et al., 2003; Schneider & Näslund, 1993; R. K. Wagner et al., 1994; Wolf & Obregón, 1992). Lexical access is often measured in a rapid naming test. Such naming requires the retrieval of phonological labels in response to visual stimuli, which can be colors, pictures, numbers, or letters (Brady, 1991). Rapid naming of letters and numbers tends to be more closely related to reading ability than rapid naming of pictured objects and colors (Compton, 2003). In a longitudinal study, Kirby et al. investigated the prediction of reading development by children's phonological awareness and naming speed performance in kindergarten. Naming speed was measured using both a picture naming task and a color naming task. Phonological awareness most strongly related to reading ability during the first 2 years of school. Naming speed, however, became increasingly more related to reading ability in the following grades. Furthermore, children who performed poorly on the phonological awareness task and the naming speed tasks in kindergarten were most likely to show reading difficulties in Grade 5, followed by the group of children who performed poorly on only the naming speed tasks in kindergarten. Nonetheless, rapid naming has also been shown to be a predictor of concurrent reading and spelling ability (De Jong & Van der Leij, 1999; Wade-Woolley & Siegel, 1997).

It seems plausible that rapidly naming objects in a second language could be more difficult for children who are less proficient in that language. If L2 children have more difficulties with lexical access tasks in the second language, this might translate into dissimilarities between L1 and L2 children in the predictive value of lexical access abilities for literacy skills. Along these lines, there are reports of poorer performance for ESL children on rapid object naming tasks in kindergarten. However, studies have shown that ESL children catch up to their L1 peers during the early stages of reading acquisition and reach levels of lexical access equal to or higher than those of L1 children by the end of kindergarten, Grade 1, or Grade 2 (Chiappe, Siegel, & Gottardo, 2002; Chiappe, Siegel, & Wade-Woolley, 2002; Lesaux & Siegel, 2003; Wade-Woolley & Siegel, 1997).

Syntactic awareness, or the level of sensitivity to the grammatical structure of a language, has also been found to be related to the development of reading and spelling skills (e.g., Bentin, Deutsch, & Liberman, 1990; Chiappe, Siegel, & Wade-Woolley, 2002; Siegel & Ryan, 1988). Although syntactic awareness is likely to be of more importance for reading comprehension and writing skills, syntactic awareness has been found to be of relevance for isolated word reading and spelling as well (Chiappe, Siegel, & Wade-Woolley, 2002; Willows & Ryan, 1986). When Willows and Ryan studied the development of grammatical sensitivity across Grades 1, 2, and 3, grammatical sensitivity was found to improve and relate significantly to reading ability in each grade. Grammatical

sensitivity also accounted for a substantial portion of the variance in word recognition. In contrast, Bentin et al. found that syntactic awareness did not differentiate between good and poor readers in their study of Hebrew-speaking children in Grade 4. Only the syntactic awareness of severely disabled readers was found to be inferior to that of both good and poor readers. In a number of studies, syntactic awareness has not been found to predict the literacy skills of L2 learners (Cormier & Kelson, 2000; Durgunoglu et al., 1993; Geva, 2000; Gottardo, Yan, Siegel, & Wade-Woolley, 2001). Syntactic awareness tasks are likely to be more challenging for L2 learners than L1 learners, as syntactic awareness tasks clearly require a certain degree of language proficiency, and several studies have indeed shown poor L2 syntactic awareness on the part of L2 learners (e.g., Chiappe & Siegel, 1999; Da Fontoura & Siegel, 1995; Droop & Verhoeven, 2003). For example, when Chiappe, Siegel, and Gottardo (2002) compared three groups of kindergarten children (i.e., native speakers of English, bilingual children, and ESL children), the native speakers showed the strongest performance on measures of syntactic awareness and the ESL children (i.e., the group with the least exposure to English) showed the weakest performance. In sum, syntactic awareness has been found to predict literacy skills for native speakers but not L2 speakers, presumably due to the weaker performance of L2 speakers on syntactic awareness tasks.

A cognitive process involved in word reading and spelling is verbal working memory (e.g., Chiappe, Siegel, & Wade-Woolley, 2002). The activity of reading requires the simultaneous processing, retention, and retrieval of information, and it therefore places a considerable demand on the individual's working memory (Siegel, 2002). Previous research has shown poor readers to have more difficulties on measures of verbal working memory (e.g., Chiappe, Hasher, & Siegel, 2000; Comeau et al., 1999; Siegel & Ryan, 1989; Swanson, 1993, 1999). In a large-scale study of the relations between working memory, inhibitory control, and reading ability for both children and adults, for instance, Chiappe et al. (2000) compared disabled and normally achieving readers. Working memory was assessed using a listening span task, and performance on the working memory task was found to generally improve up until the age of 19 years. However, disabled readers consistently showed a poorer performance on the listening span task, and the authors therefore concluded that deficits in working memory are characteristic of disabled readers of all ages. The completion of a verbal working memory task in a second language is likely to place additional demands on the working memory of the individual and, in a number of studies, poor verbal working memory performance has indeed been demonstrated for L2 learners (e.g., Chiappe, Siegel, & Gottardo, 2002; Chiappe, Siegel, & Wade-Woolley, 2002; Da Fontoura & Siegel, 1995). Lesaux and Siegel (2003) found significant differences in the working memories of native English-speaking children and ESL children in kindergarten, with the L1 children performing better on a sentence memory task than the L2 children. In Grade 2, however, they found no significant differences between the L1 and ESL children on measures of working memory. In sum, verbal working memory has been found to relate to the literacy abilities of L1 children. Although there have been reports of poorer verbal working memory skills in L2 children, it is unclear in what ways verbal working memory relates to the word reading and spelling abilities of L2 learners.

In conclusion, numerous studies have examined the relations between literacy on the one hand, and phonological awareness, lexical access, syntactic awareness, and verbal working memory on the other hand. Each of the latter has been found to be related to the word reading and spelling skills of native speakers. For L2 learners, however, contradictory findings have been reported with regard to phonological awareness, lexical access, and verbal working memory, and the relations of these to L2 literacy. The importance of such basic processes for the word reading and spelling abilities of L2 learners thus remains uncertain. The purpose of the present study was therefore to examine the levels of phonological awareness, lexical access, syntactic awareness, and verbal working memory in native English-speaking children (L1) versus ESL children during both the early stages (Grades 1 and 2) and later stages (Grades 3 and 4) of literacy development. Just how these four processes relate to the word reading and spelling abilities of the L1 and ESL children was also examined. The following specific questions were formulated for this purpose: (a) What are the differences between L1 and ESL children's levels of phonological awareness, lexical access, syntactic awareness, verbal working memory, basic word reading abilities, and basic spelling abilities? (b) To what extent are the basic word reading and spelling abilities of the L1 and ESL children predicted by their phonological awareness, lexical access, syntactic awareness, and verbal working memory?

Method

Participants

The participants were children from an inner city school in a large Canadian city. The sample consisted of 212 children, of whom 112 children were boys and 100 children were girls. The data were collected in Grades 1, 2, 3, and 4. The mean ages were 79 months in Grade 1, 92 months in Grade 2, 106 months in Grade 3, and 118 months in Grade 4. The children came from lower and middle-class families. All of the children were being educated in English. In addition, 42% of the children were native speakers of English (L1) and 58% were ESL children. The most common first languages among the ESL children were Chinese, Gujarati, Urdu, and Greek. Together, these four language groups characterized 85% of the ESL population in this study. The ESL children had generally entered the educational system knowing little or no English, which meant that they were acquiring English as they were being educated.

Data collection took place during 2 consecutive years. In the first year, the participants were children from Grades 1, 2, and 3; in the second year, the participants were children from Grades 2, 3, and 4. The children who were tested in the second year of the study were different children than those tested in the first year of the study. The tests were administered in April and May of each year. For the sake of comparison, the same measures were used for all four grades. Completion of the tests took about 45 min.

The data were pooled into four grade sets that contained the data from both years—when such data were available. Within each grade, a further distinction was made between the L1 and ESL speakers. There were 75 children in Grade 1 (31 L1 and 44 ESL children), 53 children in Grade 2 (23 L1 children and 30 ESL children), 50 children in Grade 3 (21 L1 children and 29 ESL

children), and 34 children in Grade 4 (14 L1 children and 20 ESL children).

Due to considerable changes in the populations of the grades in the second year, it was not possible to conduct a large-scale longitudinal study of the same children over time. However, additional longitudinal data were available for 84 of the 212 children. In all, 42 children were tested in both Grades 1 and 2 (19 L1 children and 23 ESL children), 20 children were tested in both Grades 2 and 3 (8 L1 children and 12 ESL children), and 22 children were tested in both Grades 3 and 4 (9 L1 children and 13 ESL children). These longitudinal data were taken into account and specifically examined.

Materials

Phonological Awareness

Phonological awareness skills were assessed using five different tasks: initial phoneme recognition, phoneme recognition and location, phoneme deletion and substitution, strip initial consonant, and the Sound Mimicry subtest of the GFW Sound Symbol Test (Goldman, Fristoe, & Woodcock, 1974). The initial phoneme recognition, phoneme recognition and location, and phoneme deletion and substitution tasks were all adapted from the similarly named tasks as used by Vandervelden and Siegel (1995).

Initial phoneme recognition. The children were instructed to listen for a particular sound and had to decide if the initial sound in a presented word was that particular sound or not (e.g., /m/—milk, map, paint, cake). The task consisted of 3 abbreviated practice items followed by 10 test items containing four words each (see the Appendix). Within each item, two words had the initial sound that was asked for. An item was considered correct when both words were identified. The maximum score on this task was 10.

Phoneme recognition and location. The children were instructed to listen for a particular sound and then decide if that particular sound was in the first part of a presented word, the second part, or not in the presented word (e.g., /t/—sit, top, milk, grass, tub, cat). The task consisted of four abbreviated practice items and nine test items containing six words each (see the Appendix). An item was considered correct when all words containing the sound that was asked for were identified. The maximum score on this task was 9.

Phoneme deletion and substitution. The children were instructed to either remove a sound from the presented words or change a sound in the words. The task involved three subtasks with six items each. In three of the items, a sound had to be removed; in the other three items, a sound had to be changed. In the first subtask, the children were asked to remove or change the initial phoneme in the words (e.g., *fill*, remove /f/; *fill*, change /f/ to /b/). In the second subtask, the children were asked to remove or change the final phoneme in the words (e.g., *goat*, remove /t/; *cup*, change /p/ to /t/). In the third subtask, the children were asked to remove or change one of the middle phonemes in the words (e.g., *slip*, remove /l/; *stick*, change /t/ to /l/). The task consisted of 2 practice items and 18 test items (see the Appendix). The maximum score on this task was 18.

Strip initial consonant. (Stanovich, Cunningham, & Cramer, 1984). The children were asked to remove the first sound of the

presented words and further told that removal of the first sound would make a new word (e.g., *pink* – *ink*). The test consisted of 1 practice item and 10 test items (see the Appendix). The maximum score on this task was 10.

GFW Sound Mimicry. The Sound Mimicry subtest from the GFW Sound Symbol Test (Goldman et al., 1974) is a measure of sound recognition and oral reproduction. The children were asked to repeat pseudowords of increasing difficulty. The task consisted of 55 items ranging in difficulty from monosyllabic pseudowords (e.g., *ab*, *at*, *id*) to polysyllabic pseudowords (e.g., *quibbest*, *wifyep*, *bajnotbem*). The task was discontinued after five consecutive errors. The maximum score on this task was 55.

In the first year of the study, extended versions of the initial phoneme recognition, phoneme recognition and location, and strip initial consonant tasks were used. The use of smaller or larger numbers of items did not affect the difficulty of the tasks and, in order to make the scores for the first and second years comparable, test scores for these tasks were converted to percentage correct scores.

Lexical Access

A rapid naming task was used to assess lexical access (see Chiappe & Siegel, 1999). This particular task was a measure of object naming speed. The children were shown a chart with five different pictures (a tree, a chair, a bird, a pear, and a car), which formed the test stimuli, and then were asked to name the five pictures. Task administration was stopped when the child was not able to successfully name the five stimuli. Subsequently, the children were presented with a card with the five stimuli appearing eight times in a different order for a total of 40 items. The children were instructed to name all of the test items as quickly as possible. The score was the number of seconds used to name all of the items correctly. For analytic purposes, the scores were converted (100 – number of seconds) to have high scores indicate faster performance and low scores indicate slower performance.

Syntactic Awareness

Syntactic awareness skills were assessed with a syntactic error judgment task (see Gottardo, Stanovich, & Siegel, 1996). The children were asked to decide if sentences were syntactically correct or not (e.g., “Clapped his hands Mark,” “The boy be sad”). The children received feedback on three practice items. The task consisted of 35 sentences, which included 12 syntactically correct sentences (see the Appendix). The sentences were presented orally. The sentence was repeated once if the child failed to respond within approximately 15 s or if the child asked for repetition. The maximum score on this task was 35.

In the first year of the study, the task was administered with a reduced number of test items. The number of items in the task did not affect the difficulty of the task and, in order to make the scores for the first and second years comparable, the scores were converted to percentage correct scores.

Verbal Working Memory

The working memory for sentences task (see Siegel & Ryan, 1989) was administered to assess the children’s verbal working

memory. The children were asked to complete simple sentences with the word missing at the end of the sentence. The sentences were presented orally. The test involved four levels of difficulty, with three sets of sentences within each level. After completion of the sentences within a set, the children were asked to repeat their responses (e.g., “An elephant is big, a mouse is ____,” “A saw is used to cut ____”; the repeated responses are *small* and *wood*). The number of sentences within the sets increased with each level and thus ranged from two to five. The test consisted of 1 practice set involving two sentences and 12 test sets (see the Appendix). The test was discontinued when a child failed an entire level. The maximum score on this task was 12.

Word Reading

Basic word reading and decoding abilities were assessed using four different tasks: Wide Range Achievement Test-3 (WRAT-3) Reading, frequent words, easy words, and pseudoword reading.

WRAT-3 Reading. The Reading subtest of the WRAT-3 (Wilkinson, 1994) was administered to assess the children’s word reading. The children were presented with a list of 42 words and asked to read the words aloud. The children were given 10 s to respond to each word. Testing was discontinued after 10 consecutive errors. Two different versions of the subtest (tan and blue forms) were randomly assigned. The maximum score on this task was 42.

Frequent words. A list of 69 high-frequency words was presented to the children (see Chiappe & Siegel, 1999; see the Appendix). The task consisted of words ranging in difficulty (e.g., *go*, *circle*, *sandwich*). The children were instructed to read the words aloud. The maximum score on this task was 69.

Easy words. A list of 40 words that varied in regularity and consistency (e.g., *most*, *paid*) was presented to the children (see Chiappe & Siegel, 1999; see the Appendix). The children were instructed to read the words aloud. The maximum score on this task was 40.

Pseudoword reading. A pseudoword reading task involving 15 test items was also administered (see Chiappe & Siegel, 1999; see the Appendix). Five of these words ended with the letter *e*, which influenced their pronunciation (e.g., *beve*, *nade*, *lope*). The children were instructed to read the words aloud. The maximum score on this task was 15.

Spelling

Basic spelling abilities were assessed using two different tasks: spelling words and spelling pseudowords.

Spelling words. The children were asked to spell 20 monosyllabic real words (see Wade-Woolley & Siegel, 1997; see the Appendix). The words were presented in isolation as well as within the context of a sentence. Eleven of the items involved consonant–vowel–consonant words (e.g., *top*, *food*); nine of the items involved initial or final consonant clusters (e.g., *grow*, *jump*). The maximum score on this task was 20.

Spelling pseudowords. The children were asked to spell 10 pseudowords (see Wade-Woolley & Siegel, 1997; see the Appendix). All of the items had a consonant–vowel–consonant structure. The correctness of the child’s spelling was evaluated on the basis of phonological rules. The maximum score on this task was 10.

Procedure

All of the measures of phonological awareness, lexical access, syntactic awareness, verbal working memory, word reading ability, and spelling ability were administered. The children were tested individually in English.

In order to answer the first question, which concerned the differences between the L1 and ESL children with regard to phonological awareness, lexical access, syntactic awareness, verbal working memory, basic word reading abilities, and basic spelling abilities, we conducted a multivariate analysis of variance (MANOVA) with grade and language as the independent variables. In relation to the first question, the longitudinal data within the sample were examined from a more developmental perspective. Children’s performances on the predictor variables and the measures of word reading and spelling abilities in the first year of the study were compared to their performance in the second year of the study (i.e., the following grade), and the effects of language and grade level on the growth in scores on each of the measures were examined. A series of repeated measures analyses of variance (ANOVAs) with time (first year of the study vs. second year of the study) as the within-subject variable and language (L1 vs. ESL) and grade level (Grades 1–2, 2–3, and 3–4) as the between-subject variables were conducted.

The second question concerned the extent to which the basic word reading and spelling abilities of the L1 and ESL children could be predicted by their phonological awareness, lexical access, syntactic awareness, and verbal working memory. In order to investigate whether the relevance of the predictor variables differed for children in different stages of literacy development, we divided the children into two groups. The younger children from Grades 1 and 2 were placed in one group, and the older children from Grades 3 and 4 were placed in a second group. In order to answer the second question, we compared correlations between the predictor variables and word reading and spelling abilities. Separate correlation analyses were conducted for L1 children from the lower grades (Grades 1 and 2) and from the upper grades (Grades 3 and 4) and for ESL children from the lower grades and the upper grades. Stepwise regression analyses were next conducted to investigate the associations between the predictor variables on the one hand and word reading and spelling abilities on the other hand. Separate regression analyses were conducted for the L1 children from the lower and the upper grades and for ESL children from the lower and the upper grades.

Z scores were calculated for the correlation and regression analyses using the entire data set at once in order to maintain growth in the scores across grades. Given that phonological awareness ability, word reading ability, and spelling ability were assessed using multiple tasks, the mean z score for each type of ability was calculated, which resulted in the following variables: overall phonological awareness, overall word reading ability, and overall spelling ability.

Results

In this study, a population of native English-speaking children was compared to a population of ESL children. The ESL population consisted of children with various first languages, which raised the question of whether differences perhaps existed within

the ESL population. To justify the decision to treat the ESL population as a single group, we first explored the performances of the four largest ESL subgroups. The ESL subgroups consisted of children who spoke either Chinese, Gujarati, Urdu, or Greek and made up 85% of the ESL population. The results of a MANOVA with overall phonological awareness, rapid naming, syntactic error judgment, working memory for sentences, overall word reading ability, and overall spelling ability as the dependent variables showed no differences between the Grades 1 through 4 ESL subgroups. Chinese-, Gujarati-, Urdu-, and Greek-speaking children performed equally on all of these variables.

Differences Between L1 and ESL Children on the Predictor Variables

Table 1 shows the mean scores and standard deviations for the measures of phonological awareness, lexical access, syntactic awareness, and verbal working memory across grades for the L1 and ESL children separately.

With respect to phonological awareness, a significant main effect of grade was observed for each task: initial phoneme recognition, $F(3, 211) = 11.13, p < .001$; phoneme recognition and location, $F(3, 211) = 12.45, p < .001$; phoneme deletion and substitution, $F(3, 211) = 39.02, p < .001$; strip initial consonant, $F(3, 211) = 25.79, p < .001$; and GFW Sound Mimicry, $F(3, 211) = 4.20, p < .05$. The children's performance on the phono-

logical awareness tasks thus improved generally as the grade level increased. Neither a significant main effect of language nor a significant interaction between grade and language was detected.

With respect to lexical access, a significant main effect of grade was found for the rapid naming task, $F(3, 211) = 21.94, p < .001$. The children produced higher scores (i.e., completed the task faster) as grade level increased. There was also a significant main effect of language, $F(1, 211) = 5.51, p < .05$. Better performance on the part of the ESL children relative to the L1 children accounted for the significant effect of language. No significant interaction effect between grade and language was found.

With respect to syntactic awareness, the children's performance on the syntactic error judgment task improved across grades. Significant main effects were found for both grade, $F(3, 211) = 29.30, p < .001$; and language, $F(1, 211) = 15.59, p < .001$. Compared to the L1 children, the ESL children performed more poorly on the syntactic error judgment task. Although the gap between the L1 and ESL children decreased in Grades 3 and 4, no significant interaction effect between grade and language was detected.

With respect to verbal working memory, the children's performance on the working memory for sentences task improved across grades. Significant main effects were again found for grade, $F(3, 211) = 52.56, p < .001$; and language, $F(1, 211) = 11.37, p < .05$. Compared to the L1 children, the ESL children performed more

Table 1
Mean Scores and Standard Deviations on Predictor Variables

Measure	Grade 1		Grade 2		Grade 3		Grade 4	
	L1	ESL	L1	ESL	L1	ESL	L1	ESL
Phonological awareness								
Initial phoneme recognition ^a								
<i>M</i>	83.87	85.04	94.20	89.25	98.41	97.70	100.00	99.58
<i>SD</i>	22.05	21.08	8.13	17.50	7.29	10.88	0.00	1.88
Phoneme recognition and location ^a								
<i>M</i>	76.30	72.94	85.70	81.26	91.51	94.80	98.41	98.88
<i>SD</i>	23.19	31.44	19.49	23.19	19.87	11.52	4.60	2.93
Phoneme deletion and substitution								
<i>M</i>	4.68	5.32	8.09	5.93	10.90	11.24	14.86	15.60
<i>SD</i>	5.40	5.45	5.58	5.36	5.18	4.44	2.28	2.14
Strip initial consonant ^a								
<i>M</i>	38.06	43.64	66.09	66.67	86.67	88.97	100.00	97.00
<i>SD</i>	46.86	46.11	41.53	38.54	29.21	22.42	0.00	13.42
GFW Sound Mimicry								
<i>M</i>	47.81	48.00	49.00	47.33	49.57	49.62	52.57	50.90
<i>SD</i>	6.02	5.68	6.07	7.74	6.05	3.41	2.10	2.69
Lexical access								
Rapid naming								
<i>M</i>	41.77	51.00	52.48	56.10	59.53	60.18	62.64	65.10
<i>SD</i>	15.07	15.01	13.34	9.62	8.39	8.44	6.51	7.52
Syntactic awareness								
Syntactic error judgment ^a								
<i>M</i>	65.97	50.11	68.48	58.55	75.95	72.41	87.14	82.50
<i>SD</i>	14.05	21.66	10.71	12.50	14.11	13.86	8.48	9.10
Verbal working memory								
Working memory for sentences								
<i>M</i>	1.61	1.36	3.04	2.33	4.43	3.79	6.29	4.65
<i>SD</i>	1.43	1.22	1.85	1.40	2.13	1.84	1.86	1.93

Note. L1 = native English speakers; ESL = speakers of English as a second language.

^a Scores reflect percentage of correct responses.

poorly on the working memory for sentences task. No significant interaction between grade and language was observed.

Additional analyses were conducted to examine the longitudinal data. A repeated measures ANOVA was performed for each of the predictor variables.

With respect to phonological awareness, significant main effects of time were found for phoneme recognition and location, $F(1, 83) = 14.68, p < .001$; phoneme deletion and substitution, $F(1, 83) = 82.99, p < .001$; and strip initial consonant, $F(1, 83) = 16.98, p < .001$. Children's performances on these tasks significantly improved between the 2 years of the study. No significant main effects of time were detected for the initial phoneme recognition and GFW Sound Mimicry tasks. No significant interaction effects between time and language; between time and grade level; and between time, language, and grade level were found for the measures of phonological awareness.

With respect to lexical access, a significant main effect of time was found for rapid naming, $F(1, 83) = 14.44, p < .001$. Children's performance on the task significantly improved between the 2 years of the study. Again, there were no significant interaction effects between time and language; between time and grade level; or between time, language, and grade level.

With respect to syntactic awareness, a significant main effect of time was found for syntactic error judgment, $F(1, 83) = 12.51, p < .05$. Children's performance on the task significantly improved between the 2 years of the study. There was a significant interaction between time and grade level, $F(2, 83) = 3.53, p < .05$. Closer inspection of this effect showed the children's longitudinal scores to improve equally from Grade 1 to Grade 2 and from Grade 2 to Grade 3 but not to improve between Grades 3 and 4. The stagnation in the longitudinal scores on the syntactic error judgment task between Grades 3 and 4 was not caused by a ceiling effect and was not found to have occurred in the larger cross-

sectional sample. No significant interaction effects between time and language and between time, language, and grade were detected.

With respect to verbal working memory, a significant main effect of time was found for working memory for sentences, $F(1, 83) = 4.47, p < .05$. Children's performance on the task significantly improved between the 2 years of the study. Again, there were no significant interaction effects between time and language; between time and grade level; or between time, language, and grade level.

Differences Between the Word Reading and Spelling Abilities of the L1 and ESL Children

Table 2 shows the mean scores and standard deviations for the measures of word reading and spelling abilities across grades for the L1 and ESL children.

With respect to the word reading abilities of the children, a significant main effect of grade was found for each task: WRAT Reading, $F(3, 211) = 87.69, p < .001$; frequent words, $F(3, 211) = 59.69, p < .001$; easy words, $F(3, 211) = 69.46, p < .001$; and pseudoword reading, $F(3, 211) = 54.72, p < .001$. In other words, the children's performance on the word reading tasks improved as their grade level increased. Although no significant main effects of language were found, there was a tendency toward slightly better performance by the ESL children on the reading tasks, and marginally significant effects of language were found for WRAT Reading, $F(1, 211) = 2.77, p = .098$; and pseudoword reading, $F(1, 211) = 3.73, p = .055$. However, the effect sizes for both WRAT Reading (partial $\eta^2 = .013$) and pseudoword reading (partial $\eta^2 = .018$) were small. There were no significant interaction effects between grade and language.

Table 2
Mean Scores and Standard Deviations on Measures of Word Reading and Spelling Abilities

Measure	Grade 1		Grade 2		Grade 3		Grade 4	
	L1	ESL	L1	ESL	L1	ESL	L1	ESL
Word reading								
WRAT Reading								
<i>M</i>	18.13	20.59	22.35	22.67	27.90	29.24	37.79	39.40
<i>SD</i>	4.70	5.88	5.93	6.55	6.53	6.32	6.85	5.01
Frequent words								
<i>M</i>	20.84	28.61	43.17	44.90	59.62	63.90	68.21	68.60
<i>SD</i>	20.96	24.39	22.55	21.53	14.59	9.57	1.25	0.75
Easy words								
<i>M</i>	8.10	13.50	22.30	22.30	33.48	34.97	38.71	38.75
<i>SD</i>	11.24	14.20	13.88	13.35	8.68	6.03	2.09	1.92
Pseudoword reading								
<i>M</i>	1.77	3.27	4.09	4.27	7.24	8.90	11.14	11.95
<i>SD</i>	3.32	3.79	3.72	3.83	4.56	4.30	2.44	2.42
Spelling								
Spelling words								
<i>M</i>	3.13	4.16	8.09	8.20	12.71	15.93	18.50	18.50
<i>SD</i>	4.61	5.69	5.98	6.34	6.14	4.36	1.34	1.85
Spelling pseudowords								
<i>M</i>	0.87	1.18	1.74	1.93	3.00	4.00	6.50	5.35
<i>SD</i>	1.48	2.04	1.89	2.38	3.18	3.00	2.10	2.64

Note. L1 = native English speakers; ESL = speakers of English as a second language; WRAT = Wide Range Achievement Test-3.

With respect to spelling abilities, the children's performance on the two spelling tasks improved across grades. A significant main effect of grade was observed for both tasks: spelling words, $F(3, 211) = 81.10, p < .001$; and spelling pseudowords, $F(3, 211) = 36.95, p < .001$. No significant main effects of language or significant interaction effects between grade and language were detected.

Additional analyses were conducted to examine the longitudinal data. A repeated measures ANOVA was performed for each measure of word reading and spelling ability. With respect to word reading ability, significant main effects of time were found for each task: WRAT Reading, $F(1, 83) = 14.35, p < .001$; frequent words, $F(1, 83) = 33.55, p < .001$; easy words, $F(1, 83) = 113.79, p < .001$; and pseudoword reading, $F(1, 83) = 6.59, p < .05$. Children's performances on these tasks significantly improved between the 2 years of the study. A significant interaction between time and language was found for one of the word reading tasks, easy words, $F(1, 83) = 4.49, p < .05$. Closer inspection of this effect showed that the ESL children started out with a substantially higher score on this task in Grade 1. The L1 children caught up to the ESL children between Grades 1 and 2 and Grades 2 and 3, which resulted in differences in progress for the L1 group. The L1 and ESL children performed at equal levels in Grades 3 and 4. A similar pattern was observed for the larger cross-sectional sample. There were significant interactions between time and grade level for two of the word reading tasks, frequent words, $F(2, 83) = 5.89, p < .05$; and easy words, $F(2, 83) = 19.49, p < .001$. For both tasks, the interactions between time and grade level were due to a ceiling effect. The children had already attained a near-maximum score in Grade 3, which left little room for improvement between Grades 3 and 4 and resulted in differences in progress between the different grade levels. The same pattern was found for the larger cross-sectional sample. There was no significant interaction between time, language, and grade level.

With respect to spelling ability, a significant main effect of time was found for spelling words, $F(1, 83) = 11.48, p < .001$; children's performance on the task significantly improved between the 2 years of the study. There was no significant main effect of time for spelling pseudowords. No significant interaction effects were detected between time and language; between time and grade level; or between time, language, and grade level.

Predictors of Word Reading and Spelling Abilities for L1 Learners

To determine the associations between the predictor variables and measures of word reading and spelling abilities for L1 learners, we compared correlations for the L1 children from the lower grades (1–2) and the upper grades (3–4). The correlations are displayed in Table 3. The correlation between lexical access and syntactic awareness was not significant for L1 children from either the lower grades or the upper grades. All other correlations were significant at the .05 or .001 levels. In general, the strongest associations were found between phonological awareness and word reading and spelling abilities, and between verbal working memory and word reading and spelling abilities. Phonological awareness was more strongly related to word reading ability in the upper grades. Lexical access however, was slightly more strongly related to word reading ability in the lower grades. The correlations between syntactic awareness on the one hand, and word reading ability and spelling ability on the other hand, were also stronger in the upper grades. Likewise, the correlation between verbal working memory and spelling ability was slightly stronger in the upper grades. Some of the intercorrelations between the predictor variables varied in strength for L1 children from the lower and the upper grades. For the upper grades, phonological awareness was more strongly related to lexical access, and syn-

Table 3
Correlations Between Predictor Variables and Word Reading and Spelling Abilities for L1 Children From Lower and Upper Grades

Measure	1	2	3	4	5	6
1. Phonological awareness						
Lower grades (1–2)	—					
Upper grades (3–4)	—					
2. Lexical access						
Lower grades (1–2)	.347*	—				
Upper grades (3–4)	.537**	—				
3. Syntactic awareness						
Lower grades (1–2)	.638**	.133	—			
Upper grades (3–4)	.588**	.211	—			
4. Verbal working memory						
Lower grades (1–2)	.547**	.501**	.467**	—		
Upper grades (3–4)	.600**	.516**	.587**	—		
5. Word reading ability						
Lower grades (1–2)	.687**	.546**	.367**	.630**	—	
Upper grades (3–4)	.863**	.466**	.697**	.688**	—	
6. Spelling ability						
Lower grades (1–2)	.715**	.378**	.475**	.602**	.851**	—
Upper grades (3–4)	.691**	.459**	.744**	.713**	.844**	—

Note. L1 lower grades, $n = 54$; L1 upper grades, $n = 35$. L1 = native English speakers.
* $p < .05$. ** $p < .001$.

tactic awareness was more strongly related to verbal working memory.

To examine the extent to which L1 children’s word reading and spelling abilities were predicted by phonological awareness, lexical access, syntactic awareness, and verbal working memory, we conducted separate stepwise regression analyses for children from the lower grades and the upper grades. The results of the regression analyses for L1 word reading ability and spelling ability are displayed in Table 4.

With respect to word reading ability, three of the four predictor variables contributed significantly to the prediction of L1 word reading ability in the lower grades. Syntactic awareness was thus excluded, and the model with phonological awareness, lexical access, and verbal working memory was found to explain 59% of the variance in L1 word reading ability in the lower grades. Phonological awareness was the strongest predictor and accounted for 46% of the variance in word reading ability in the lower grades. For the upper grades, two of the four predictor variables contributed significantly to the prediction of L1 word reading ability. Lexical access and verbal working memory were not significant predictors and were thus excluded. The model with phonological awareness and syntactic awareness explained 79% of the variance in L1 word reading ability in the upper grades. Phonological awareness was again found to be the strongest predictor and to account for 74% of the variance in word reading ability in the upper grades.

With respect to spelling ability, two of the four predictor variables contributed significantly to the prediction of L1 spelling ability in the lower grades. Lexical access and syntactic awareness were not significant predictors and were therefore excluded. The model with phonological awareness and verbal working memory was found to explain 56% of the variance in L1 spelling ability in the lower grades. Phonological awareness was again the strongest predictor and accounted for 50% of the variance in spelling ability in the lower grades. For the upper grades, two of the four predictor variables contributed significantly to the prediction of L1 spelling

ability. Phonological awareness and lexical access were not significant predictors and were excluded. The model with syntactic awareness and verbal working memory explained 65% of the variance in L1 spelling ability in the upper grades. Here, syntactic awareness was found to be the strongest predictor and to account for 54% of the variance in spelling ability in the upper grades.

Predictors of Word Reading and Spelling Abilities for L2 Learners

To determine the associations between the predictor variables and measures of word reading and spelling abilities for L2 learners, we compared correlations for the ESL children from the lower grades (1–2) and the upper grades (3–4). The correlations are displayed in Table 5. The correlation between lexical access and syntactic awareness was not significant for the upper grades, and the correlation between lexical access and verbal working memory was not significant for either the lower or upper grades. All other correlations were significant at the .05 or .001 level. The strongest associations were found between phonological awareness and word reading ability and spelling ability, although the association was slightly weaker for ESL children from the lower grades. Likewise, the correlations between lexical access and syntactic awareness on the one hand, and word reading ability and spelling ability on the other hand, were slightly higher for the upper grades. The intercorrelations between the predictor variables were relatively equal for ESL children from the lower and upper grades.

To examine the extent to which ESL children’s word reading and spelling abilities were predicted by phonological awareness, lexical access, syntactic awareness, and verbal working memory, we conducted separate stepwise regression analyses for children from the lower grades and from the upper grades. The results of the regression analyses for ESL word reading ability and spelling ability are displayed in Table 6.

With respect to word reading ability, two of the four predictor variables contributed significantly to the prediction of ESL word reading ability in the lower grades. Syntactic awareness and verbal working memory were not significant predictors and were thus excluded. The model with phonological awareness and lexical access explained 40% of the variance in ESL word reading ability in the lower grades. Phonological awareness was the strongest predictor and accounted for 36% of the variance in word reading ability in the lower grades. Similarly, two of the four predictor variables contributed significantly to the prediction of ESL word reading ability for the upper grades. Syntactic awareness and verbal working memory were not significant predictors and were therefore excluded. The model with phonological awareness and lexical access explained 47% of the variance in ESL word reading ability in the upper grades. Again, phonological awareness was the strongest predictor and accounted for 42% of the variance in word reading ability in the upper grades.

With respect to spelling ability, only one predictor variable contributed significantly to the prediction of ESL spelling ability in the lower grades. Syntactic awareness, verbal working memory, and lexical access were not significant predictors of ESL spelling ability in the lower grades, although lexical access was marginally significant ($p = .09$) and would explain an additional 3% of the variance if it were included in the model. The model with phonological awareness was found to explain 24% of the variance in

Table 4
Stepwise Regression Models of Predictors of Word Reading and Spelling Abilities for L1 Children From Lower and Upper Grades

Predictor variable	Adjusted R^2	ΔR^2	p
L1 word reading ability			
Lower grades (1–2)			
Phonological awareness	.462	.472	<.001
Lexical access	.563	.108	<.05
Verbal working memory	.592	.036	<.05
Upper grades (3–4)			
Phonological awareness	.737	.745	<.001
Syntactic awareness	.787	.055	<.05
L1 spelling ability			
Lower grades (1–2)			
Phonological awareness	.502	.512	<.001
Verbal working memory	.558	.063	<.05
Upper grades (3–4)			
Syntactic awareness	.540	.553	<.001
Verbal working memory	.649	.117	<.05

Note. L1 lower grades, $n = 54$; L1 upper grades, $n = 35$. L1 = native English speakers.

Table 5
Correlations Between Predictor Variables and Word Reading and Spelling Abilities for ESL Children From Lower and Upper Grades

Measure	1	2	3	4	5	6
1. Phonological awareness						
Lower grades (1–2)	—					
Upper grades (3–4)	—					
2. Lexical access						
Lower grades (1–2)	.356**	—				
Upper grades (3–4)	.379**	—				
3. Syntactic awareness						
Lower grades (1–2)	.505**	.250*	—			
Upper grades (3–4)	.455**	.201	—			
4. Verbal working memory						
Lower grades (1–2)	.466**	.190	.474**	—		
Upper grades (3–4)	.504**	.278	.427**	—		
5. Word reading ability						
Lower grades (1–2)	.604**	.420**	.357**	.370**	—	
Upper grades (3–4)	.661**	.465**	.428**	.375**	—	
6. Spelling ability						
Lower grades (1–2)	.502**	.340**	.354**	.332**	.840**	—
Upper grades (3–4)	.602**	.462**	.407**	.385**	.785**	—

Note. ESL lower grades, $n = 74$; ESL upper grades, $n = 49$. ESL = speakers of English as a second language.
* $p < .05$. ** $p < .001$.

ESL spelling ability in the lower grades. For the upper grades, two of the four predictor variables contributed significantly to the prediction of ESL spelling ability. Syntactic awareness and verbal working memory were not significant predictors and were excluded. The model with phonological awareness and lexical access was found to explain 40% of the variance in ESL spelling ability in the upper grades. Phonological awareness was again found to be the strongest predictor and to account for 35% of the variance in spelling ability in the upper grades.

Discussion

The first question in this study concerned the differences in the performances of L1 and ESL children. L1 and ESL children's

Table 6
Stepwise Regression Models of Predictors of Word Reading and Spelling Abilities in ESL Children From Lower and Upper Grades

Predictor variable	Adjusted R^2	ΔR^2	p
ESL word reading ability			
Lower grades (1–2)			
Phonological awareness	.355	.364	<.001
Lexical access	.396	.048	<.05
Upper grades (3–4)			
Phonological awareness	.424	.436	<.001
Lexical access	.468	.054	<.05
ESL spelling ability			
Lower grades (1–2)			
Phonological awareness	.241	.252	<.001
Upper grades (3–4)			
Phonological awareness	.349	.363	<.001
Lexical access	.402	.064	<.05

Note. ESL lower grades, $n = 74$; ESL upper grades, $n = 49$. ESL = speakers of English as a second language.

phonological awareness, lexical access, syntactic awareness, verbal working memory, word reading, and spelling were compared.

The results show the development of ESL phonological awareness to greatly resemble the development of L1 phonological awareness. A steady growth in phonological awareness across grades was found for both the L1 and ESL groups with no apparent differences in the phonological awareness of the L1 and ESL children. In other words, phonological awareness of ESL does not appear to depend on English-language proficiency. These findings are consistent with prior reports of equal phonological awareness on the parts of L1 and ESL children (e.g., Chiappe & Siegel, 1999; Chiappe, Siegel, & Wade-Woolley, 2002). There were no indications of accelerated phonological awareness on the part of the L2 learners, as has been reported by some researchers (e.g., Bruck & Genesee, 1995; Campbell & Sais, 1995). However, it is possible that the phonological awareness measures used in this study were not sufficiently sensitive, particularly in the higher grades. A more complex phonological task might discriminate better between the L1 and ESL learners and—speaking speculatively—show the ESL children to be at an advantage with respect to phonological awareness.

For both the L1 and ESL groups, lexical access—measured with a rapid naming task—also improved across grades. The ESL children performed at a higher level than the L1 children, which is consistent with the results of previous research showing equal or better rapid naming for ESL children during the early stages of literacy acquisition relative to L1 children (e.g., Chiappe & Siegel, 1999; Chiappe, Siegel, & Gottardo, 2002; Chiappe, Siegel, & Wade-Woolley, 2002; Lesaux & Siegel, 2003).

Syntactic awareness was clearly difficult for the ESL children, whose scores were lower than those of the L1 children. Similar results have also been found in other studies (e.g., Chiappe & Siegel, 1999; Da Fontoura & Siegel, 1995). Both the L1 and ESL children's syntactic awareness improved across grades, and al-

though the differences between the L1 and ESL children declined with grade, it is not clear whether the ESL children will reach native-like levels of syntactic awareness in later grades.

Finally, the verbal working memories of the L1 and ESL children steadily improved across grades, but the ESL children performed more poorly than the L1 children. The task that was used, namely working memory for sentences, required a certain level of proficiency in English, which may account for the weaker performance of the ESL children relative to the L1 children. Furthermore, the mere completion of the task in the second language may have placed an additional demand on the ESL children's working memory, which could also have affected their performance.

The results of the longitudinal analyses show that, despite some minor differences, the phonological awareness, lexical access, syntactic awareness, and verbal working memories of the L1 and ESL children basically improved at equal rates throughout Grades 1 through 4. In other words, although the L1 and ESL children achieved at different levels on some of the predictors, the growth in their scores was equal.

As can be expected, the word reading and spelling skills of the children improved across grades. L1 and ESL children were found to have equal word and pseudoword reading and spelling abilities. The results of the longitudinal analyses further show that the ESL children had a small advantage over L1 children in basic word reading ability in the lower grades. Aside from this advantage, the amount of progress in reading and spelling ability that L1 and ESL children made in each grade seemed to be equal. ESL children's poorer performance on the verbal working memory and syntactic awareness tasks did not appear to influence their word reading and spelling development, which is in keeping with the results of previous studies showing equivalent word and pseudoword reading and also spelling abilities for L1 and L2 learners (e.g., Margolese & Kline, 1999; Share & Stanovich, 1995; Verhoeven, 1990, 2000; D. A. Wagner et al., 1989).

In conclusion, the phonological awareness, word and pseudoword reading, and word and pseudoword spelling abilities of the L1 and ESL children appeared to be quite similar. The ESL children were at an advantage with regard to lexical access, whereas their syntactic awareness and verbal working memories were weaker when compared to those of the L1 children.

The second question addressed the ability of phonological awareness, lexical access, syntactic awareness, and verbal working memory to predict the word reading and spelling abilities of L1 and ESL children. The goal was to investigate whether word reading and spelling abilities rely upon the same underlying processes in children in the early stages of literacy acquisition (Grades 1 and 2) and in children in more advanced stages of literacy acquisition (Grades 3 and 4), and to examine whether the same processes are relevant in L1 and ESL children's word reading and spelling abilities in the lower grades (1–2) and the upper grades (3–4).

The associations between the predictor variables and word reading and spelling abilities in L1 children from lower grades and the upper grades were compared. In the lower as well as the upper grades, phonological awareness and verbal working memory were strongly related to word reading and spelling abilities. Not all associations between the predictor variables and literacy skills were equally strong for L1 children from the lower and upper grades. Whereas lexical access was more strongly related to word

reading ability in the lower grades, phonological awareness and syntactic awareness were more strongly related to word reading ability in the upper grades. Syntactic awareness and verbal working memory were more strongly related to spelling ability in the upper grades. Similarly, the associations between the predictor variables and word reading and spelling abilities in ESL children from lower grades and the upper grades were compared. Phonological awareness was strongly related to word reading and spelling abilities. The correlations between the predictor variables and word reading and spelling abilities were slightly higher for ESL children from the upper grades.

In L1 as well as ESL children from the upper grades, lexical access, syntactic awareness, and verbal working memory each were approximately as closely related to reading ability as they were to spelling ability. When differences in the strength of an association between lower and upper grades were observed, the association between a predictor variable and word reading or spelling ability was generally stronger for the upper grades. It is important to keep in mind that the predictor variables and word reading and spelling abilities were measured concurrently; the current findings do not imply that the strengths of the associations increase over time. Comparing the relations among the predictor variables and literacy skills between L1 and ESL children, a number of discrepancies in the strengths of the relations become apparent. The largest discrepancy was found for the associations between verbal working memory and word reading and spelling abilities, which were substantially weaker for all ESL children. The associations between syntactic awareness and word reading and spelling abilities were substantially weaker for ESL children from the upper grades. Compared to the L1 children, the association between syntactic awareness and spelling ability, and the association between lexical access and word reading ability, were somewhat weaker for ESL children from the lower grades.

The word reading regression models for L1 and ESL children from the lower and upper grades were compared. In L1 children from the lower grades, phonological awareness, lexical access, and verbal working memory explained 59% of the variance in word reading ability. In the upper grades, L1 word reading ability was explained by phonological awareness and syntactic awareness, and together they explained 79% of the variance. In both lower and upper grades, phonological awareness was the strongest predictor and accounted for a substantial portion of the variance in word reading ability. In ESL children, phonological awareness and lexical access were the two processes found to predict word reading ability in both lower and upper grades. In the lower grades, 40% of the variance in ESL word reading ability was explained. In the upper grades, the two processes explained 47% of the variance in ESL word reading ability. Phonological awareness was the strongest predictor of ESL word reading abilities in the lower and upper grades.

Comparing the word reading regression models for L1 children to those for ESL children, it becomes clear that the current predictors accounted for substantially more variance in L1 word reading ability. L1 and ESL children from the lower grades had in common the two strongest predictors of word reading ability, phonological awareness and lexical access. However, both phonological awareness and lexical access explained a larger portion of the variance in L1 word reading ability. Word reading ability for L1 children from the lower grades was further explained by an

additional predictor: verbal working memory. The L1 and ESL children from the upper grades had in common the strongest predictor of word reading ability, phonological awareness. Similar as for ESL children from the lower grades, ESL word reading ability in the upper grades was further explained by lexical access. Although L1 word reading ability was found to rely on lexical access in the lower grades, it did not predict L1 word reading ability in the upper grades. Here, L1 word reading ability in the upper grades was further explained by syntactic awareness.

The spelling regression models for L1 and ESL children from the lower and upper grades were compared. For L1 children from the lower grades, 56% of the variance in spelling ability was explained by phonological awareness and verbal working memory. In the upper grades, syntactic awareness and verbal working memory explained 65% of the variance in L1 spelling ability. Although phonological awareness was the strongest predictor of L1 spelling ability in the lower grades, it was no longer a predictor in the upper grades. In ESL children from the lower grades, phonological awareness was the only significant predictor, and it explained 24% of the variance in spelling ability. In the upper grades, phonological awareness and lexical access explained 40% of the variance in ESL spelling ability.

Comparison of the regression models for L1 and ESL spelling ability shows that—similar to the models for word reading ability—more variance was accounted for in L1 spelling ability. The L1 and ESL children from the lower grades had in common the strongest predictor of spelling ability, phonological awareness. L1 spelling ability in the lower grades was further explained by verbal working memory, whereas ESL spelling ability had no further predictors. The fact that only one of the predictors that was included in the present study was found to explain ESL spelling ability in the lower grades, and that only a relatively small portion of the variance was accounted for, indicates that other processes might be of greater or additional influence on young ESL children's spelling acquisition. In the upper grades, the L1 and ESL children did not have any predictors of spelling ability in common. L1 spelling ability in the upper grades was explained by syntactic awareness and, similar to ability in the lower grades, was further explained by verbal working memory. Similar to ability in ESL children in the lower grades, phonological awareness was the strongest predictor of ESL spelling ability in the upper grades. Lexical access was a further predictor of ESL spelling ability in the upper grades.

In conclusion, phonological awareness was the strongest predictor of L1 and ESL word reading ability in Grades 1 through 4. Also, phonological awareness was the strongest predictor of L1 spelling ability in Grades 1 and 2 and of ESL spelling ability in Grades 1 through 4. These findings are consistent with the body of research indicating that phonological awareness is the most important predictor of reading and spelling ability in L1 as well as in ESL children (e.g., Bryant et al., 1990; Cormier & Kelson, 2000; Høien et al., 1995; Stanovich, 1988; R. K. Wagner et al., 1994). Lexical access, measured with a rapid naming task, was the second strongest predictor of L1 word reading ability in Grades 1 and 2 and of ESL word reading ability in Grades 1 through 4. Kirby et al. (2003) reported an increasing effect of lexical access, measured in kindergarten, on reading ability in higher grades. The present study shows that when lexical access and reading ability are simultaneously assessed in higher grades (i.e., Grades 3 and 4),

lexical access no longer predicts the word reading ability of L1 children. Lexical access was not a predictor of L1 spelling ability in Grades 1 through 4, but it was a predictor of ESL spelling ability in Grades 3 and 4. After phonological awareness, lexical access was the only additional predictor of ESL word reading and spelling abilities. Because ESL children were found to have higher levels of lexical access than L1 children, it is possible that speed of lexical retrieval serves as a compensation mechanism in ESL children. Whereas L1 children's word reading and spelling abilities to some extent rely on syntactic awareness and verbal working memory, ESL children cannot avail of these types of linguistic awareness. Yet L1 and ESL children have equal levels of reading and spelling abilities. ESL children might be able to utilize their abilities in lexical access more effectively, compensating for their lower abilities in verbal working memory and syntactic awareness. Another possibility is that the ESL children's word reading and spelling abilities can be partly attributed to factors that were not measured within the context of the present study. Bilingual children and L2 learners have been found, for example, to have better control of linguistic processing (Bialystok, 1988) and higher levels of executive functioning (Bialystok, 1999) than L1 learners, which may in turn facilitate their reading development. Although others have found syntactic awareness to contribute to the prediction of (typically L1) word reading ability (e.g., Willows & Ryan, 1986), the present study found evidence for only a limited role of syntactic awareness in literacy abilities. Within the context of the current study, syntactic awareness was a predictor of word reading and spelling ability in L1 children from Grades 3 and 4 and did not seem to be involved in word reading and spelling abilities in L1 children from Grades 1 and 2. The failure of syntactic awareness to predict ESL word reading and spelling abilities is in keeping with the results reported by Cormier and Kelson, Durgunoğlu et al. (1993), and Gottardo et al. (2001). Verbal working memory was found to be a predictor of L1 word reading ability in Grades 1 and 2 and L1 spelling ability in Grades 1 through 4, but it was not a predictor of ESL word reading and spelling abilities. The finding that verbal working memory had no predictive value for the word reading and spelling abilities of the ESL children may be due to the fact that the task was administered in the children's second language and thus resulted in lower scores than might have been the case had the task been administered in the children's first language. In other words, this finding does not necessarily imply that verbal working memory plays no role in ESL children's literacy skills.

This study has a number of limitations that must be considered. The same tasks were used in all four grades to facilitate comparison, and some ceiling effects thus presented themselves. Ceiling effects occurred for three of the phonological measures in Grade 4, namely initial phoneme recognition, phoneme recognition and location, and strip initial consonant. On the initial phoneme recognition task, the children in Grade 3 had already produced almost the maximum score. Despite such ceiling effects, phonological awareness was still found to be the strongest predictor of word reading ability for the older children from Grades 3 and 4. Ceiling effects also occurred for some of the measures of word reading and spelling ability in Grade 4, namely frequent words, easy words, and spelling words.

Although the analyses of the longitudinal data available within the present database provided some additional information on the

development of a number of the processes and the literacy abilities assessed here, the number of participants tested in 2 consecutive years was limited. This means that the numbers of participants for the different subgroups were very small, and the results of the longitudinal analyses should therefore be interpreted with caution.

The results of the present study hold for children's word reading and word spelling abilities. If the prediction of children's reading comprehension and text writing abilities were considered, different outcomes might be obtained. The reading comprehension of L2 learners has often been reported to be inferior to the reading comprehension of L1 learners. Consideration of reading comprehension and writing abilities would undoubtedly provide a fuller picture of ESL children's functional reading and spelling skills. Although syntactic awareness and verbal working memory did not appear to play a role in the prediction of ESL children's reading and spelling abilities at the word level, it is likely that such factors would influence reading comprehension and writing ability. Measures of reading comprehension and writing ability should thus be considered in future research.

The actual language proficiency of the ESL children in the present study could not be determined as no measures of English oral vocabulary knowledge or listening comprehension were included. Such language proficiency measures might have been helpful for the interpretation of some of the results, specifically the outcomes for syntactic awareness and verbal working memory. The ESL children in the present study generally entered the school system with little or no English proficiency, and it therefore seems safe to assume that they had less than optimal English proficiency in Grades 1 through 4.

The results of the present study have a number of practical implications. Phonological awareness was found to be of great importance for the development of literacy skills in both L1 and ESL children. The training of phonological awareness skills should therefore be encouraged for children of all linguistic backgrounds.

Despite the presumably lower levels of oral language proficiency that can be expected for young L2 learners, the ESL children in the present study showed equal levels of word reading and spelling ability when compared to the L1 children. In other words, the ESL children appeared to gain just as much from literacy instruction as the L1 children. However, L2 learners are still likely to benefit from additional instruction or assistance with regard to other aspects of their education.

In closing, it is important to note that the findings of this study apply to basic literacy skills and not to reading comprehension or text writing ability. Weaker reading comprehension skills often found in ESL children are not likely to be caused by poor decoding skills but are more likely to be a result of weaker second language proficiency and possibly of sociocultural differences. That is, the necessary linguistic knowledge and background knowledge required to comprehend certain texts may simply be lacking. Educators should therefore strive to improve ESL children's vocabularies and overall proficiency in the English language in order to remedy any difficulties with reading comprehension.

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Appendix

Test Items of the Measures of Phonological Awareness, Syntactic Awareness,
Verbal Working Memory, Reading, and Spelling**Initial phoneme recognition**

Maximum score: 10

Practice items:

Listen for /s/ in /sock/. Does /sock/ start with /s/?

Listen for /s/ in /fat/. Does /fat/ start with /s/?

Listen for /s/ in /soup/. Does /soup/ start with /s/?

Test items:

1. /s/: sock fat soup meat
2. /m/: milk map paint cake
3. /f/: head foot stick face
4. /t/: pen take top duck
5. /b/: cook hot boot beard
6. /k/: kiss kite bad gate
7. /p/: duck put plant black
8. /p/: dime cup duck top
9. /h/: farm hip head gas
10. /g/: gum boat goat cup

Phoneme recognition and location

Maximum score: 9

Practice Items:

Listen for /s/ in /snake/. Is it the first sound, the last sound, or not in the word?

Listen for /s/ in /mess/. Is it the first sound, the last sound, or not in the word?

Listen for /k/ in /park/. Is it the first sound, the last sound, or not in the word?

Listen for /k/ in /ten/. Is it the first sound, the last sound, or not in the word?

Test Items:

1. /s/: neck – sun – class – grass – sick – pen
2. /m/: milk – ham – sit – pen – moan – comb
3. /f/: girl – calf – fat – fruit – knife – class
4. /t/: sit – top – milk – grass – tub – cat
5. /b/: bike – milk – cab – bus – tub – nose
6. /k/: milk – fat – kill – sick – toe – cup
7. /p/: soap – neck – ape – grass – pill – pen
8. /d/: milk – mad – dog – dip – ride – class
9. /g/: gum – dog – cab – bag – girl – nose

Phoneme deletion and substitution

Maximum score: 18

Practice items:

Say /doll/. Now say it again, but don't say /d/.

Say /doll/. Now say it again, but instead of /d/ say /w/.

Test items:

Initial

1. fill (remove /f/)
2. cup (remove /c/)
3. bat (remove /b/)
4. fill (change /f/ to /b/)

5. cup (change /c/ to /p/)

6. bat (change /b/ to /s/)

Final

1. goat (remove /t/)
2. make (remove /k/)
3. seal (remove /l/)
4. fill (change /l/ to /t/)
5. cup (change /p/ to /t/)
6. bite (change /t/ to /k/)

Blends

1. slip (remove /l/)
2. stick (remove /t/)
3. nest (remove /s/)
4. crest (change /s/ to /p/)
5. slip (change /l/ to /n/)
6. stick (change /t/ to /l/)

Strip initial consonant

Maximum score: 10

Practice item:

task (take away /t/)

Test items:

- | | |
|---------|----------|
| 1. pink | 6. bus |
| 2. told | 7. pitch |
| 3. man | 8. car |
| 4. nice | 9. hit |
| 5. win | 10. pout |

Syntactic error judgment

Maximum score: 35

Practice items:

To school go I. Right or wrong?

This is a chair. Right or wrong?

I am sit. Right or wrong?

Test items:

1. Clapped his hands Mark.
2. The sun shone brightly.
3. The bear brown growled.
4. They went at school.
5. He answered the ringing phone.
6. I are happy.
7. The boy run quickly.
8. We thanked him much very.
9. The waiter dropped the tray of plates.
10. The boy be sad.
11. The child the letter wrote.
12. The woman turned on the light.
13. The lion and the tiger lives in the jungle.
14. The tourists traveled on car.
15. Many of the children dressed up for the party.
16. The children's mother work very hard.

(Appendix continues)

17. The art the many artists displayed.
18. They went to visit their relatives on England.
19. The boy was chased by the dog.
20. They watched sadly as the cowboy rode the sunset into.
21. The flock of geese are on the lake.
22. Was reading the young woman the mystery novel.
23. When it rains, we wear our boots.
24. The tall, thin man playing was basketball.
25. The presentation for the award was done by the Queen.
26. The class was eager to see the movie.
27. The children with the young teacher enjoys the school trip.
28. The school of brightly colored fish swam past the boat.
29. The new television were watching the people.
30. The plan was developed to cooperate with famous scientists.
31. One of the children are sick.
32. The child, raking the leaves, helps her parents.
33. The business person, waiting for the flight.
34. The visitor who wears the dark glasses are friendly.
35. The racing car traveled quickly quite.

Working memory for sentences

Maximum score: 12

Practice items:

1A

When we go swimming we wear bathing _____ (suits).

Cars have to stop at a red _____ (light).

Repeated responses _____ (suits, light).

Test items:

2A

In a baseball game, the pitcher throws the _____.

On my two hands, I have ten _____.

Repeated responses _____.

2B

A turtle is slow, a rabbit is _____.

When we are sick we often go to the _____.

Repeated responses _____.

2C

An elephant is big, a mouse is _____.

A saw is used to cut _____.

Repeated responses _____.

3A

Running is fast, walking is _____.

At the library people read _____.

An apple is red, a banana is _____.

Repeated responses _____.

3B

The sun shines during the day, the moon at _____.

In the winter we have to shovel _____.

The young child had black hair and brown _____.

Repeated responses _____.

3C

In the summer it is very _____.

People go to see monkeys in a _____.

To cut meat we use a sharp _____.

Repeated responses _____.

4A

Please pass the salt and _____.

When our hands are cold we wear _____.

On my way to school I mailed a _____.

After swimming I was soaking _____.

Repeated responses _____.

4B

Snow is white, coal is _____.

After school the children walked _____.

A bird flies, a fish _____.

In the barn, the farmer milked the _____.

Repeated responses _____.

4C

In the autumn the leaves fall off the _____.

We eat soup with a _____.

On hot days I go to the pool to _____.

Repeated responses _____.

5A

For the party, the girl bought a pretty pink _____.

Cotton is soft and rocks are _____.

Once a week we wash the kitchen _____.

In the spring the farmer plows the _____.

I throw the ball up and then it comes _____.

Repeated responses _____.

5B

In the fall, we need to rake _____.

At a birthday party, we usually eat ice cream and _____.

Sand paper is rough but glass is _____.

In a garden, the workers pick ears of _____.

Over the fields, the girl rode the galloping _____.

Repeated responses _____.

5C

With dinner we sometimes eat bread and _____.

In the daytime it is light, and at night it is _____.

Dogs have four _____.

At the grocery store we buy _____.

A man is big, a baby is _____.

Repeated responses _____.

Frequent words

Maximum score: 69

Test items:

- | | | |
|-------------|--------------|--------------|
| 1. find | 24. on | 47. cleaning |
| 2. orange | 25. put | 48. drawing |
| 3. bike | 26. shoe | 49. reading |
| 4. car | 27. under | 50. you |
| 5. truck | 28. here | 51. zebra |
| 6. rabbit | 29. jumping | 52. go |
| 7. colour | 30. make | 53. box |
| 8. sandwich | 31. running | 54. says |
| 9. duck | 32. walk | 55. went |
| 10. circle | 33. sitting | 56. going |
| 11. good | 34. playing | 57. all |
| 12. little | 35. standing | 58. some |
| 13. boy | 36. chase | 59. had |
| 14. join | 37. this | 60. over |
| 15. mother | 38. want | 61. stop |
| 16. the | 39. have | 62. zoo |
| 17. a | 40. they | 63. rain |
| 18. happy | 41. giraffe | 64. cut |
| 19. yes | 42. me | 65. dirty |
| 20. came | 43. monster | 66. house |
| 21. chair | 44. down | 67. jumps |
| 22. in | 45. out | 68. stairs |
| 23. is | 46. up | 69. writing |

Easy Words

Maximum score: 40

Test items:

- 1. have 11. now 21. when 31. like
- 2. best 12. put 22. give 32. home
- 3. seen 13. five 23. both 33. shown
- 4. head 14. goes 24. beard 34. move
- 5. full 15. set 25. gave 35. game
- 6. what 16. days 26. moth 36. that
- 7. most 17. does 27. soon 37. deep
- 8. food 18. good 28. paid 38. four
- 9. come 19. but 29. heard 39. says
- 10. said 20. came 30. feet 40. lost

Pseudoword reading

Maximum score: 15

Test items:

- 1. bav 6. mul 11. beve
- 2. dut 7. sep 12. nade
- 3. lod 8. lin 13. lope
- 4. tid 9. kef 14. mude
- 5. pov 10. hap 15. tipe

Spelling words

Maximum score: 20

Test items:

- 1. The book is on the top of the pile. top
- 2. Some of the children have brown eyes. some
- 3. The baby ate food. food
- 4. The Raptors play basket-ball. ball

- 5. How high can you jump? jump
- 6. A year has 365 days. year
- 7. I love bright, sunny days. love
- 8. Many children walk to school. walk
- 9. He went back to school on Monday. back
- 10. They found their lost puppy. lost
- 11. She will wear a dress to the party. wear
- 12. He told us to enjoy ourselves at the park. told
- 13. The king and queen rule the country. king
- 14. I live at home. home
- 15. Farmers grow corn. grow
- 16. Look in the drawers for socks. look
- 17. The plane flew from Toronto to Montreal. plane
- 18. The stove is hot. stove
- 19. After they finished, they were done. done
- 20. A bear is a wild animal. wild

Spelling pseudowords

Maximum score: 10

Test items:

- 1. bup 6. caba
- 2. kib 7. voke
- 3. nad 8. yite
- 4. pob 9. meve
- 5. ves 10. pume

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b. Paid Circulation (By Mail and Outside the Mail)	2289	2356
c. Total Paid Circulation (Sum of 15b (1), (2), (3), and (4))	550	604
d. Free or Nominal Rate Outside-County Copies Included on PS Form 3541	2039	2560
e. Free or Nominal Rate In-County Copies Included on PS Form 3541	225	225
f. Total Free or Nominal Rate Distribution (Sum of 15d (1), (2), (3), and (4))	225	225
g. Total Distribution (Sum of 15c and 15e)	3064	3185
h. Copies not Distributed (See Instructions to Publishers #4 (page #3))	303	273
i. Total (Sum of 15f and g)	3367	3458
j. Paid and Nominal Rate (15c divided by 15f times 100)	93%	93%

16. Publication of Statement of Ownership:
 If the publication is a general publication, publication of this statement is required. Will be printed in the December 2007 issue of this publication.
 Publication not required.
 17. Signature and Title of Publisher, Business Manager, or Owner: Barbara Spivak, Dir. Service Center Operations Date: 10/11/07
 I certify that all information furnished on this form is true and complete. I understand that anyone who furnishes false or misleading information on this form or who omits material or information requested on the form may be subject to criminal sanctions (including fines and imprisonment) and/or civil sanctions (including civil penalties).
 PS Form 3526, September 2006 (Page 2 of 3)