Article

The International Journal of Bilingualism

International Journal of Bilingualism
15(1) 3–25

DOI: 10.1177/1367006910371022
Ijb.sagepub.com

Individual differences in second language reading outcomes

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Abstract
This study examined whether individual variance in letter-name knowledge and phonological processing assessed in English (L1) in kindergarten French immersion students predicts their French (L2) decoding and reading comprehension scores at the end of grade 1; whether L2 oral language factors also contribute significantly to predictions of variability in L2 reading outcomes beyond knowledge of the alphabet and phonological processing; and whether the Simple View of Reading – SVR – (Gough & Tunmer, 1986) applies cross-linguistically as well as intra-linguistically. We administered a comprehensive battery of predictor tests that have been correlated with L1 decoding and comprehension skills in English to English-speaking students in early total French immersion at the beginning and end of kindergarten. Tests of word and pseudo-word decoding and reading comprehension in French were given at the end of grade 1. The best kindergarten predictors of L2 decoding were knowledge of the alphabetic principle in English, phonological awareness in English, and knowledge of French at kindergarten entry. The same variables were significant predictors of French reading comprehension, with the added contribution of scores related to oral language skills in L1. The results provide support for the SVR intra-linguistically, but not cross-linguistically.

Keywords
decoding, oral language, predictors, reading comprehension

1. Individual differences in second language reading acquisition: a study of early French immersion students

French immersion programs were first introduced in Canada in St Lambert, Quebec, in 1965. The St Lambert program was an early total immersion program in French so that the participating students received all instruction, including initial reading and writing instruction, in French from kindergarten until the end of grade 2 at which time English was introduced in the form of English language arts instruction. At the time that it was first introduced, immersion education was regarded as a radical departure from conventional education because, among other reasons, students received initial literacy instruction in a language that they were not proficient in. Research conducted on the

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outcomes of immersion since its inception has found that the participating students attain the same levels of achievement in reading and writing in English as native English-speaking students attending English language programs, although they may experience short term lags in literacy development during those grades when French is used as an exclusive language of instruction (Genesee, 1978; Lambert & Tucker, 1972; Swain & Lapkin, 1982). Immersion students have also been found to demonstrate the same levels of proficiency in listening and speaking in English as their peers instructed through English (see Genesee, 2004, for a recent review). At the same time, immersion students attain a level of proficiency in all aspects of French as a second language (L2) that is superior to that of English-speaking students who receive language arts instruction in French for short periods each day.

Research has also examined the suitability of immersion for students who have academic difficulty in school and who tend to attain relatively low levels of achievement; namely students with low levels of intellectual/academic ability and with poor first language abilities and students from disadvantaged socio-economic and minority ethnic group backgrounds. These studies have found that such students reach the same levels of achievement in reading and writing in English as comparably disadvantaged students in all-English programs (see Genesee 2007, for a review) and, at the same time, they achieve higher levels of proficiency in reading and writing in French than similar students in conventional French-as-a-second language classes. Aside from these studies, there is relatively little empirical investigation of individual differences in achievement among French immersion students and, in particular, individual differences in reading achievement. Learning to read is critical for ensuring academic success in school because beyond the primary grades reading is essential for learning academic subject matter and skills. Reading is equally, if not more, important in immersion because, despite the overall success of students in reading achievement, as just noted, there is a high rate of attrition from immersion programs due, in part at least, to reading difficulty (e.g. Halsall, 1994; Hogan & Harris, 2004; Obadia & Thériault, 1997; Parkin, Morrison, & Watkin, 1987).

Understanding individual differences in the reading achievement of immersion students early in their education is critical for determining the suitability of immersion for students who might experience difficulty in learning to read in French as a second language. It is also vital for both the early identification of those at risk for reading difficulties and impairment and planning differentiated instruction and intervention for students who require additional support to avoid developing chronic reading difficulties. Early identification and early targeted intervention have been found to maximize response to intervention (e.g. Scanlon, Gelzheiser, Vellutino, Schatschneider, & Sweeney, 2008) and to help prevent reading difficulties altogether (e.g. Scanlon, Anderson, & Flynn, 2008). The study of individual differences in L2 reading acquisition also implicates important theoretical issues, including the extent to which first language (L1) and L2 reading acquisition are the same and/or different and in what ways they are the same and different; and, of chief concern in the present study, whether and which L1 abilities are related to L2 reading acquisition and to what extent they are related.

The goal of the present study was to examine the role of L1 skills in explaining individual differences in L2 reading attainment in native English-speaking students in early French immersion. Aside from its contribution to our understanding of cross-linguistic issues in reading acquisition, understanding the role of L1 skills in L2 reading acquisition is important for practical reasons; such as whether indices of L1 ability can be used to predict L2 reading outcomes and how early in schooling reliable predictions of risk for reading difficulty can be made cross-linguistically. The use of L1 indices to identify individual differences in reading achievement in immersion students would facilitate early identification and intervention of immersion students who might need

additional support to acquire L2 reading skills successfully before their French skills are sufficiently developed to permit accurate assessment.

2. Individual differences in first language reading acquisition

There is an extensive body of research on correlates and predictors of individual differences in L1 reading acquisition with a preponderance on early stages – that is, word decoding, and much less attention to later stages that implicate comprehension. Whether focusing on decoding or reading comprehension outcomes, studies vary widely with respect to the range of predictor variables they have considered and whether they take a prospective or concurrent approach to predicting individual differences. Most studies of word decoding have included measures of phonological processing and a measure of knowledge of the alphabetic principle, with some studies also including indices of cognitive ability, oral language ability, and perceptual skills (auditory, visual), among others. Phonological processing includes an overlapping but partially distinct set of skills: phonological awareness (PA), the most studied phonological processing skill – often measured using blending or elision tasks; phonological access – often measured using rapid automatized naming tasks; and phonological memory – often measured by sentence repetition or backward digit recall tasks (Wagner & Torgesen, 1987). Despite some variation, in the aggregate, studies of L1 decoding of real or pseudo-words indicate that phonological processing abilities, along with knowledge of the alphabetic principle (letter-sound/name knowledge), are the most important predictors of decoding ability (e.g. Bowey, 2005; National Reading Panel, 2000; Schatschneider, Fletcher, Francis, Carlson, & Foorman, 2004). The predictive power of these two variables has been impressive. Specifically, studies have found that letter-name knowledge may account for between 25 and 35 per cent of variance in word decoding ability up to one year later (e.g. Bowey, 1994; Schatschneider et al., 2004). The predictive role of phonological processing has been found to be at least as important as that of letter-name knowledge, with performance on tasks such as blending, sentence repetition, and rapid automatized naming in kindergarten predicting up to 40 per cent of the variance in word reading at the end of grade 2. Of the phonological processing skills, phonological awareness has been overwhelmingly identified by researchers as the most significant predictor of word reading (National Reading Panel, 2000). Recent evidence suggests further that, among the various measures of phonological awareness, small-unit measures (e.g. individual phonemes) may be particularly good predictors of later reading outcomes as compared to larger unit measures (e.g. syllables; National Early Literacy Panel, 2008).

Vocabulary has also been found to be an important predictor of decoding in many studies, but there is evidence suggesting that its role may be negligible when age and IQ are adequately controlled (Byrne & Fielding-Barnsley, 1993; McGuinness, 2005). This makes sense when we consider that receptive vocabulary is the subtest that is most highly correlated with performance IQ (Sattler, 1988), as pointed out by Byrne (1998). The evidence for a predictive role of vocabulary with respect to later stages of reading, namely reading comprehension, is more robust (National Reading Panel, 2000; Schatschneider et al., 2004).

Although much less research has been carried out on reading comprehension, and thus our understanding of L1 reading comprehension is still emerging, extant findings suggest that the picture with respect to individual differences in L1 reading comprehension is more complex than that for decoding and that the factors that correlate with individual differences in reading comprehension may differ at different stages of development (Johnston, Barnes, & Desrochers, 2008). Storch and Whitehurst (2002), for example, found that the most significant predictors of comprehension accuracy in the primary grades were word-related reading skills (i.e. phonological awareness and

letter knowledge), but that oral language skills (i.e. vocabulary, narrative recall, and syntactic ability) were significant predictors of comprehension in grades 3 and 4. The Simple View of Reading (Gough & Tunmer, 1986), one of the earliest, most investigated and still most popular theories of reading comprehension, emphasizes these two component skills and it was therefore selected and its applicability to our data explored. Briefly, according to the Simple View, reading comprehension (RC) is equal to the product of decoding (D) and language comprehension (LC); that is, RC = D x LC (Hoover & Gough, 1990). However, others, including Chen and Vellutino (1997) and Savage and his colleagues (Kirby & Savage, 2008; Savage 2006; Savage & Wolforth, 2007) have been unable to replicate the multiplicative effect with English L1 learners. Close inspection of Hoover and Gough's original report reveals that their theory was based on findings from a cohort of English-L2 learners. Taken together, these findings argue for an additive model of reading acquisition in English-L1 children (Chen & Vellutino and Savage and colleagues' data) and a multiplicative model in English-L2 readers (Hoover & Gough data). Studies of reading comprehension in students in even later elementary grades (grade 5 and later) suggest that even higher order skills, such as inference-making ability, comprehension monitoring, and sensitivity to story structure, play a significant role in comprehension of advanced level texts (Cornoldi, DeBeni, & Pazzaglia, 1996; Muter, Hulme, Snowling, & Stevenson, 2004; Oakhill, Cain, & Bryant, 2003).

3. Individual differences in L2 reading achievement

Studies of L2 reading acquisition have sought to determine if the same factors that are linked to individual differences in L1 reading achievement are also related to L2 reading achievement and whether there are cross-linguistic influences in L2 reading acquisition (e.g. see August & Shanahan, 2006, and Genesee, Lindholm-Leary, Saunders, & Christian, 2006, for reviews of research on English language learners; and Genesee & Jared, 2008, for a review of French immersion students). A number of researchers have reported significant correlations between reading achievement in English and French of English-speaking students in French immersion programs. More specifically, Geva and Clifton (1994) report concurrent correlations of more than .70 between English and French measures of passage reading accuracy, passage reading time and retelling, and word identification in a study of grade 2 total French immersion students. Similarly, Comeau, Cormier, Grandmaison, and Lacroix (1999) found that word identification scores for French immersion students were highly correlated across languages (.84 for students in grades 1, 3, and 5 combined, and .87 one year later), as did Deacon, Wade-Woolley, and Kirby (2007), who obtained cross-language concurrent correlations of .85 in grade 1, .74 in grade 2, and .77 in grade 3. In a related vein, Bournot-Trites and Denizot (2005) found that kindergarten and grade 1 immersion students who were considered at-risk for reading difficulty according to their performance on English tests (including knowledge of letter names, phonological awareness, and word and non-word repetition) were also identified as at-risk based on their performance on a similar battery of French language tests.

Studies of predictors of individual differences in reading achievement in French immersion students have reported evidence of cross-linguistic effects in correlations between the component skills that are thought to support reading development and measures of reading achievement itself. In an early study, Comeau et al. (1999) found that scores on tests of phonological awareness in English and in French, phonological short-term memory in English, and phonological access in English, administered in grades 1, 3, and 5, were all significantly correlated with word decoding skills in French and English one year later. As has been found in studies of L1 reading achievement, phonological awareness scores in either language accounted for almost 74 per cent of the variance in French word identification scores after age, gender, nonverbal IQ, phonological access

(in English), and non-word repetition (based on English) were taken into account. The same predictors (averaged across the three grades) accounted for 80 per cent of variance in English word identification scores (see also Deacon et al., 2007). MacCoubrey, Wade-Woolley, Klinger, and Kirby (2004) found that phonological awareness skills in English of grade 1 total French immersion students were the best discriminators of students who were successful and those who were poor English word readers, whereas both phonological access and phonological awareness in English discriminated between successful and at-risk readers of French words.

Tingley et al. (2004) examined which specific phonological awareness skills (syllable, onset-rime, phoneme) were correlated with the French and English decoding of kindergarten and grade 1 French immersion students. They observed that onset-rime and phoneme awareness scores were correlated significantly with word and non-word reading scores in both English and French; but, that syllable awareness was significantly correlated only with performance on French-derived non-words. Syllable awareness may be particularly important for French word decoding because French is a syllable-timed language. Although most attention has focused on phonological awareness as a predictor of subsequent L2 reading ability, Deacon et al. (2007) argue that morphological awareness skills may also be important in accounting for individual differences in French L2 reading achievement. They found that morphological awareness skills in French, assessed using a past-tense analogy task, accounted for significant variance in the French word identification scores of grade 1 to 3 immersion students and in the English word identification skills of grade 1 and 2 students.

Jared, Cormier, Levy, & Wade-Woolley (2006) have conducted an extensive longitudinal study of individual differences in reading achievement in early French immersion students in three largely monolingual English urban centers in Canada (London, Moncton, and Hamilton). They examined the English-L1 and French-L2 reading outcomes (word decoding and comprehension) of French immersion students from kindergarten (K) to grade 3. Jared and her colleagues found that PA, phonological access, and word reading assessed in English in the spring of K were the best predictors of grade 3 French decoding, whereas non-verbal IQ, receptive grammar, and PA were the best K predictors of grade 3 French reading comprehension, in this order of importance, respectively. Immersion students' knowledge of French (i.e. French vocabulary) at K entry did not correlate significantly with reading outcome, arguably because the students had had so little exposure to French that there had to be insufficient variance in French knowledge to serve as a significant correlate of later reading. Prior knowledge of French might play a more significant role in French L2 reading acquisition among students living in settings such as Montreal, where French is prevalent. In fact, the role of L2 vocabulary with respect to L2 decoding abilities is unclear. Some studies have found that L2 vocabulary contributes significantly and uniquely, albeit modestly, to the prediction of L2 decoding (Abu-Rabia, 1997; Arab-Moghaddam & Sénéchal, 2001; Da Fontoura & Siegel, 1995; Gottardo, 2002; Muter & Diethelm, 2001), while others have not (Geva, Yaghoub-Zadeh, & Schuster, 2000; Jared et al., 2006; Quiroga, Lemos-Britten, Mostafapour, Abbott, & Berninger, 2002). In contrast to the studies reported here and to the present study, over 70 per cent of the children in the Jared study received simultaneous literacy instruction in English and French, beginning in K. As a result, some of the cross-linguistic effects reported by Jared may have been the result of simultaneous literacy instruction in both languages.

4. The present study

The present study is part of an ongoing longitudinal examination of the reading achievement of English-speaking students in an early total French immersion program outside Montreal. When completed, the same students will have been assessed in the fall and spring of kindergarten and in

the spring of grades 1 to 3. The results presented here pertain to the first phase of testing (fall of kindergarten to spring of grade 1) and focus on word decoding skills and early comprehension skills in French. The study addresses a number of unexplored issues and also provides useful replication of results from current studies. Like other studies reviewed earlier, we examined the extent to which L1 reading-related skills (i.e. phonological awareness and letter-sound knowledge) predict L2 word decoding. We focused on immersion students who were taught initial literacy skills in French only permitting us to examine cross-linguistic effects on L2 reading acquisition that are not influenced by dual language literacy instruction, as was the case in Jared et al.'s (2006) study. Our predictor measures were administered in the fall and spring of kindergarten permitting us to examine how early in schooling significant and reliable predictions of French-L2 reading outcomes can be made. To date, no other study has examined predictors of L2 reading achievement among French immersion students from such an early age. The earlier the prediction of risk for reading difficulties, the earlier individualized intervention can be provided (Scanlon, Gelzheiser et al., 2008) and the better the chances of avoiding later reading failure (Scanlon, Anderson et al., 2008). We included a broad range of oral language measures along with measures of phonological processing and letter-sound knowledge in order to determine whether and which oral language skills contribute significantly to predictions of French reading outcomes. While it is widely thought that oral language skills are critical for acquisition of reading skills in an L2, at present, we have little understanding of which oral language skills are important and whether the same kinds of oral language skills are important in early and later stages of reading acquisition. Better understanding of which oral language skills are important for L2 reading acquisition would increase the accuracy with which struggling readers could be identified and, as well, would serve to help define the kinds of interventions that would be most effective when providing additional support to struggling readers (National Reading Panel, 2000). Conducting the study in Quebec permitted us to examine the role of prior L2 exposure. In fact, a number of children in our study had some working knowledge of French, although all were English dominant. Some knowledge of the target language prior to schooling is not uncommon in most communities where students are learning to read via a second language; for example, English language learners. In addition to the aforementioned issues, we also sought to examine the extent to which the Simple View of Reading applies to L2 reading comprehension cross-linguistically (i.e. from English to French). This permits us to explore predictors of L2 reading comprehension, an aspect of L2 reading acquisition that has rarely been examined in the case of French immersion.

5. Method

5.1 Participants

The participating children were attending elementary schools in a region outside of greater Montreal. The geographical area served by these schools includes primarily francophone families, but there are numerous pockets of anglophone and bilingual (French and English) families as well. The socio-economic status of the children who attend these schools varies from low to high. According to our questionnaire results, the mean number of years of the children's mothers' education was 13. These schools were selected because they have a relatively high proportion of monolingual English and English-dominant students. Parents whose children were about to begin kindergarten (K) attended a meeting with the research team and permission was sought to include their child in the study if the child was monolingual English or English-dominant. Written consent was initially obtained for 90 K children from the immersion program, although 4 participants discontinued (2 children moved, 1 child switched from immersion to core English, and consent was

not received in grade 1 for one child). The remaining 86 children completed K and grade 1 testing. These children were in 12 different classrooms in 7 different schools.

Based on information obtained from the children's parents via a questionnaire (see description of *Parent Questionnaire* later in this article) and scores on standardized French (*Échelle de vocabulaire en images Peabody*, or EVIP) and English (*Peabody Picture Vocabulary Test*, or PPVT) receptive vocabulary tests administered to the children in the fall of K (see description of *EVIP* and *PPVT* later in the article), it was determined that 41 of the children were monolingual English (mean EVIP standard score of 60, and mean PPVT standard score of 107) and 45 were English-dominant bilinguals (mean EVIP standard score of 87 and mean PPVT standard score of103). In the fall of K, the children ranged in age from 4 years 9 months to 6 years with a mean age of 5 years 6 months.

5.2 Materials

Language, reading-related, and various control tests were administered to all children in the fall of K (Time 1), in the spring of K (Time 2), and in the spring of grade 1 (Time 3). In addition, questionnaires were sent to all parents in the fall of K. A brief description of each measure follows. The tests have been classified as language-related, reading-related, and control measures.

Language-related predictor measures. Oral language skills, which were used as predictors, were assessed using tasks that tap into vocabulary, grammar, and phonological memory.

English and French receptive vocabulary skills were assessed in the Fall of K and were entered into the regression analyses to control for differences in general English and French language proficiency at the beginning of schooling. The *Peabody Picture Vocabulary Test* – IIIA (PPVT-IIIA; Dunn & Dunn, 1997) was administered to assess English receptive vocabulary (nouns, verbs, and adjectives). Each child was required to point to the picture from a plate of four pictures that best represented a word spoken by the examiner. Internal reliability for this test is reported to be $r = .94$. The *Échelle de vocabulaire en images Peabody* (EVIP; Dunn, Thériault-Whalen, & Dunn, 1993) was administered to assess French receptive vocabulary. The EVIP is a standardized French adaptation of the PPVT-R. Internal reliability is reported to be $r = .82$.

Receptive and expressive grammar in English was assessed using the Sentence Structure subtest of the *Clinical Evaluation of Language Fundamentals*-4 (CELF-4; Semel, Wiig, & Secord, 2003) and the *Test of Early Grammatical Impairment* (TEGI; Rice & Wexler, 2001). These tests were administered at Time 1 (fall-K), Time 2 (spring-K), and Time 3. The Sentence Structure subtest of the CELF-4 evaluates a child's comprehension of syntax. Sentences were read aloud to the child and he or she was asked to point to one picture among four that best corresponded to the spoken sentence (e.g. 'The first two children are in line, but the third child is still playing.'). CELF-4 subtest stability coefficients range from $r = .74$ to $r = .93$, as reported in the manual. The TEGI was administered to evaluate each child's morphological development (i.e. 3rd person-*s* and regular and irregular past tense). The child is prompted, with the help of pictures and verbal models, to produce *subject* + *verb* present or past tense phrases (e.g. 'Here, the girl is skating. Here, she is finished. Tell me what she did.'). This test was designed to identify children at-risk for oral language impairment. Stability coefficients ranging from $r = .82$ to $r = .95$ are reported in the TEGI manual for the expressive grammar probes.

A French adaptation of the Sentence Structure subtest of the CELF-4 was administered at Time 3 in order to test the Simple View of Reading in French-L2. It was used to assess French listening comprehension and, of our measures, this is the test that most closely paralleled our reading comprehension measure.

Reading-related predictor measures. Reading-related skills that were used as predictors were tasks that tap into phonological processing and knowledge of the alphabetic principal.

Phonological processing was assessed using tasks that tap into phonological awareness (PA), phonological access, and phonological memory. PA was assessed at Time 1 and Time 2 using an experimental English blending task, a measure that assesses the ability to combine sounds to form real words. Children were auditorily presented with two or three isolated syllables comprising a consonant followed by a vowel (cv: 't-ea'), a vowel followed by a consonant (vc: 'ea-t'), or a consonant followed by a vowel and a consonant (cvc: 'b-ea-t'), and were asked to put them together (i.e. blend) to make a word. Each syllable was phonologically balanced across syllable conditions (e.g. tea-eat-beat). Inter-rater reliability was $r = .99$ (T1) and $r = .92$ (T2). The Spearman-Brown reliability was $r = .92$ (T1) and $r = .94$ (T2).

Phonological access was assessed at Times 1 and 2 by the ability to rapidly retrieve the names of visual symbols using the Rapid Automatized Naming and Rapid Alternating Stimulus Tests (RAN/RAS; Wolf & Denckla, 2005; original English version). Children were required to rapidly name a series of objects, colors, letters, numbers, a combination of letters and numbers, and a combination of letters, numbers and colors. Both alphanumeric (numbers) and non-alphanumeric (objects) subtests were included because there is evidence that alphanumeric naming may be more closely associated with decoding accuracy (e.g. Savage & Frederickson, 2005), while non-alphanumeric naming may be more closely associated with more general language deficits (e.g. Catts, Gillespie, Leonard, Kail, & Miller, 2002) or attention problems (e.g. Purvis & Tannock, 2000). Each subtest was administered only if the child could independently name the 5 practice items of each subtest (e.g. the number test plate was only administered if the child could name the 5 numbers on this plate). Errors produced during rapid automatized naming were not factored into the score so that a child who made many inconsistent errors (e.g. said 'red' instead of 'green') would obtain the same score as a child who did not make any errors, as long as the actual speed of naming all the items on a test plate was the same. Test-retest reliability ranged from $r = .81$ to $r = .98$ for this test, as reported in the manual.

The *Children's Test of Non-Word Repetition* (CNRep; Gathercole & Baddeley, 1996; original English version) was administered at Time 1 and Time 2 to assess phonological short-term memory. Each child was asked to repeat 40 pseudo-words presented via a tape recorder (e.g. 'perplisteronk'). The child's renditions of each were later scored for accuracy. Sound substitutions and omissions were scored as errors. Inter-rater reliability was $r = .82$ (T1) and $r = .84$ (T2).

Letter-name knowledge in English was assessed at Times 2 and 3 using the *Wide Range Achievement Test*-3: blue reading subtest (WRAT-3; Wilkinson, 1993), a measure of a child's ability to recognize and name letters. Children were asked to name 15 uppercase letters. Median test coefficient alphas ranged from $r = .82$ to $r = .95$.

Letter-name knowledge in French was assessed at Time 1 and Time 2 using a French adaptation of the *Wide Range Achievement Test*-3: blue reading subtest (WRAT-3; Wilkinson, 1993), a measure of a child's ability to recognize and name letters. Children were asked to name 15 uppercase letters. Inter-rater reliability was $r = .96$ (T1) and $r = .94$ (Time 2). The Spearman-Brown reliability was $r = .94$ (T1) and $r = .96$ (T2).

Reading achievement measures. Decoding in French was assessed at Time 3 (grade 1) using the *Wechsler Individual Achievement Test*-Second Edition: French-Canadian (WIAT-II^{CDN}, Wechsler, 2005; original French version). Only the word and pseudo-word identification subtests (*Lecture de mots* and *Décodage de pseudo-mots*) were administered, and only items that required decoding were administered (some items of the original WIAT-II^{CDN} word decoding subtest actually assess

PA rather than decoding). Word identification involved the child reading a list of real words out loud, and pseudo-word identification involved reading pseudo-words out loud accurately and fluently. Reliability coefficients for the WIAT-II^{CDN} are reported to be $r = .99$ for word identification and $r = .97$ for pseudo-word identification.

We included pseudo-word decoding as an outcome measure in addition to word decoding because the former is not confounded with vocabulary knowledge and, thus, pseudo-word reading is a 'pure' measure of decoding. It was our goal to examine whether the same predictors were related to these two forms of word reading. Pseudo-word decoding in English was assessed at Time 3 (grade 1) in order to test the Simple View of Reading in French-L2. The Word Attack subtest of the Woodcock-Johnson III Tests of Achievement (WJACH-III; Woodcock, McGrew, & Mather, 2001) was used. Pseudo-word identification involved reading pseudo-words out loud accurately and fluently. Reliability coefficients for the WJACH-III are reported to be $r = .94$ for pseudo-word identification. Reading comprehension was assessed at Time 3 using the *Batterie d'échelles multidimensionnelles pour l'évaluation de la lecture* (BEMEL; Cormier, Desrochers, & Sénéchal, 2006), an experimental measure of literacy skills in French. Only the word comprehension and sentence comprehension subtests were administered. For word comprehension, each child read 30 single words, one at a time, and pointed to the picture of the category that the word belonged to (body part, clothing, bird, fruit, or color). For sentence comprehension, the child read 28 sentences ranging from 3 to 11 words in length, one at a time, and pointed to the picture that was a match with the sentence from a set of four pictures. The Spearman-Brown reliability was $r = .87$ (words) and $r = .87$ (sentences).

Control measures. The following control measures were administered at Time 1: (a) hearing screening, (b) vision screening, and (c) non-verbal cognitive ability.

Hearing screening was conducted at Time 1 using a calibrated, portable audiometer. Under earphones, hearing was tested in each ear separately at 500, 1000, 2000, and 4000 Hz. To pass the hearing screening, children had to reliably respond at a minimum of 20 dB at 1000, 2000, and 4000 Hz, in at least one ear.

Vision screening was conducted using the Rosenbaum Pocket Vision Screener (© 1970), a near vision visual acuity screener based on the Snellen eye chart. The child had to identify letters and numbers presented at a distance of 14 inches, one eye at a time (the eye not being tested was covered with an eye patch). To pass the vision screening, the child had to correctly name at least all but two items in one row at an acuity level of 20/30 or better, in each eye. Vision screening was postponed until Time 2 or, if necessary, Time 3, if a child could not reliably identify letters or numbers that comprised the test.

Non-verbal cognitive ability was assessed using the *Colored Progressive Matrices* (CPM; Raven, Raven, & Court, 1998). The child was required to look at a visual pattern and determine which one of six individual pieces best completed the test pattern. Internal reliability is reported to range from $r = 70$ to $r = .80$.

Questionnaires. At Time 1, parents were asked to complete a questionnaire containing questions related to language background, family history, socio-economic status, and the child's health, developmental milestones, and exposure to reading and books.

5.3 Procedure

A battery of tests was administered to each child at Time 1 (October–November 2005), a second battery of tests was administered at Time 2 (April–May 2006), and a third was administered to each

child at Time 3 (April–May 2007). At each testing time, the order of test administration was held constant across participants.

Testing conditions. Each session lasted between 20 and 45 minutes and each child was generally only seen once per day. French and English tests were not administered on the same day, except for some French control measures and English tests that were conducted on the same day because many children had very limited French skills at that time and it was felt that an entire session conducted exclusively in French would leave some children feeling discouraged. The same test was never given in both languages on the same day.

Examiners. The research team was composed of research assistants trained and supervised by an experienced and certified clinical speech-language pathologist (CE). Each child was seen by at least two, sometimes three, different examiners over the course of testing.

6. Results

Inspection of the fall-K data (using the *descriptives* procedure of SPSS to generate z scores from raw scores) revealed that the following variables had skewed distributions and each contained between one and three outliers (> |3.0| SD): TEGI total (mean of TEGI 3rd person-s and TEGI past tense), English WRAT-3, and Raven's CPM. See Table 2 for the means and standard deviations of each measure from the fall-K testing. Distributional normality was achieved by reversing the scores and applying a square root transformation (TEGI total), applying a square root transformation only (English WRAT-3), or applying a natural log transformation (Raven's CPM) (Altman, 1991). Even after these transformations were applied, one outlier remained among the Raven's CPM scores ($z = +3.11$) and two among the English WRAT-3 scores ($z = -3.37$, $z = -3.37$). These were kept in the analyses. There was an elevated rate of zero scores for the English blending (cv, vc, and cvc) task suggesting that this test was too difficult for many of the children. We, therefore, recoded this variable into a binary categorical variable: children who were unable to blend at least one vc item were given a code of 1 and those who succeeded at blending at least one vc item were given a code of 2. It should be noted that only blending vc was entered into our regression analyses because preliminary regression analyses revealed that cv and cvc did not contribute significantly to the prediction of reading above and beyond the variance that vc contributed.

Inspection of the spring-K data revealed that the TEGI total, the English WRAT, and the Objects subtest of English RAN/RAS had skewed distributions and contained between one and three outliers each. See Table 1 for the means and standard deviations of each measure in the spring-K testing. Distributional normality was achieved by reversing the scores and applying a square root transformation (TEGI total), a natural log transformation (Objects subtest of English RAN/RAS), or a square root transformation only (English WRAT). Despite applying transformations where appropriate, one outlier remained among the TEGI total scores ($z = +3.62$) and the Objects subtest of the English RAN/RAS scores ($z = +3.84$). Again, there was an elevated rate of zero scores for the English blending tasks (though less so than in fall-K). As before, these results were recoded as a binary categorical variable. For the reasons stated earlier, blending vc was again the only blending subtest entered into the regression analyses.

Step-wise regression analyses were carried out to identify significant predictors of grade 1 L2 reading outcomes; separate analyses were run for word decoding, pseudo-word decoding, and reading comprehension. Separate analyses were also conducted using the fall- and the spring-K predictors in order to examine the differential predictive ability of the fall- versus spring-K

Table 1. Means and standard deviations of all variables included in the analyses

	Fall-K					Spring-K					Spring-Gr 1				
	N	Min.	Max.	Mean	SD	*N*	Min.	Max.	Mean	SD	*N*	Min.	Max.	Mean	SD
Age in months	86	59	73	67	4										
IQ	86	11	36	18	4										
Rec. voc. (F)	86	1	94	29	19										
Rec. voc. (E)	86	46	115	81	15										
Blending	86	0	9	3	3	86	0	9	5	4					
RAN-o (E)	85	38	120	71	17	86	40	124	68	16					
RAN-n (E)	61	33	169	64	22	77	28	154	63	23					
Pwd rep. (E)	86	2	34	18	6	86	3	27	15	6					
Lnk (E)	86	0	15	10	4	86	3	15	12	4					
Word dec. (E)	86	0	16	1	2	86	0	15	1	2					
Exp. mor. (E)	86	6	100	83	19	86	5	100	88	15	86	0	100	91	13
Word dec. (F)											86	0	70	26	19
Pwd dec. (E)											86	2	26	7	5
Pwd dec. (F)											86	0	53	18	14
Word rdg comp. (F)											86	6	30	20	6
Sentence rdg comp. (F)											86	4	28	21	6
List. comp. (E)											86	18	26	24	2
List. comp. (F)											86	10	26	21	3

Note. K = Kindergarten, Gr = grade, pwd dec. = pseudo-word decoding, rdg comp. = reading comprehension, F = French, E = English, rec. = receptive, exp. = expressive, voc. = vocabulary, rep. = repetition, mor. = morphology, Lnk = letter-name knowledge, RAN-o = rapid automatized naming-objects, RAN-n = rapid automatized naming-numbers, list. comp. = listening comprehension.

predictor scores. Thus, six regression analyses in total were conducted. With the exception of French and English receptive vocabulary, only predictor measures that were administered both in English and in French and both in the fall and spring of K were included in the analyses. The same K predictor measures were used in all analyses: French receptive vocabulary (EVIP-A), English receptive vocabulary (PPVT-IIIA), English pseudo-word repetition (CNRep), English blending, English expressive morphology (TEGI total), English letter-name knowledge (WRAT-3), English word decoding (WRAT-4), and English rapid automatized naming of objects (RAN/RAS-Objects subtest). We included pseudo-word decoding as an outcome variable in addition to word decoding since the former is not confounded with vocabulary knowledge, and it was our goal to examine whether some variables are uniquely predictive of only one of these two partially overlapping outcome variables. Fall scores on the English and French receptive vocabulary tests were included as control measures in all analyses (whether fall or spring predictors were being analyzed) to control for initial levels of general proficiency in each language. *Z* scores were used in all analyses. Analyses were run using both transformed and non-transformed scores and since there were no differences in the overall amount of variance accounted for or in individual regression coefficients, statistical results using non-transformed scores are reported for ease of interpretation.

The results for word decoding, pseudo-word decoding, and reading comprehension are presented and discussed separately; as are the results using fall-K and spring-K predictors. Table 2 provides a summary of the simple correlations between the variables included in the regression analyses. Table 3 summarizes the results of the regression analyses.

Table 2. Bivariate Pearson correlation coefficients of variables included in regression analyses

K to grade 1

	1	2	3	4	5	6	7	8	9	10	11	12
1. K Rec. voc. (F)		–0.150	0.247	–0.107	–0.157	–0.099	–0.054	–0.067	–0.036	0.212	0.171	0.290[b]
2. K Rec. voc. (E)	–0.150		0.254	0.206	0.452[b]	0.274	0.160	–0.403[b]	0.032	0.131	0.157	0.222
3. K Pwd rep. (E)	0.223[a]	0.237[a]		0.238	0.326[b]	0.292[b]	0.365[b]	–0.395[b]	–0.320	0.299[b]	0.267	0.380[b]
4. K Blending (E)	–0.100	0.193	0.070		0.244	0.459[b]	0.218	–0.130	0.081	0.320[b]	0.331[b]	0.496[b]
5. K Exp. mor. (E)	0.046	0.369[b]	0.225[a]	0.257[a]		0.375[b]	0.154	–0.375[b]	–0.132	0.166	0.144	0.205
6. K Lnk (E)	–0.002	0.117	0.092	0.339[b]	0.282[b]		0.250	–0.413[b]	–0.423[b]	0.433[b]	0.468[b]	0.554[b]
7. K Word dec. (E)	0.019	0.094	0.168	0.451[b]	0.142	0.262[a]		–0.236	–0.278	0.247	0.236	0.239
8. K RAN-o (E)	–0.034	–0.232[a]	–0.275[a]	–0.381[b]	–0.183	–0.240[a]	–0.364[b]		0.557[b]	–0.317[b]	–0.311[b]	–0.439[b]
9. K RAN-n (E)	–0.143	0.005	–0.272[a]	–0.276[a]	–0.018	–0.194	–0.332[b]	0.530[b]		–0.358[b]	–0.267	–0.383[b]
10. Gr 1 Word dec. (F)	0.212[a]	0.131	0.205	0.504[b]	0.145	0.317[b]	0.437[b]	–0.372[b]	–0.424[b]		0.827[b]	0.756[b]
11. Gr 1 Pwd dec. (F)	0.171	0.157	0.242[a]	0.484[b]	0.223[a]	0.353[b]	0.391[b]	–0.371[b]	–0.400[b]	0.827[b]		0.697[b]
12. Gr 1 Rdg comp. (F)	0.290[b]	0.222[a]	0.289[b]	0.556[b]	0.190	0.438[b]	0.354[b]	–0.404[b]	–0.469[b]	0.756[b]	0.697[b]	

Spring of grade 1: Concurrent

	13	14	15	16	17	18
13. List. comp. (F)		0.319[b]	0.478[b]	0.208	0.812[b]	–0.318[b]
14. Pwd dec. (F)			0.135	0.723[b]	0.812[b]	0.110
15. List. comp. (E)				0.104	0.378[b]	–0.269[a]
16. Pwd dec. (E)					0.573[b]	0.018
17. Sum of 1 & 2 (F)						–0.128
18. Product of 1 & 2 (F)						

Note. [a] $p < .05$, [b] $p < .01$ (two-tailed); values above the diagonal represent fall of K to spring of Grade 1 Pearson correlation coefficients; values below the diagonal represent spring of K to spring of Grade 1 correlations; K = Kindergarten, word = word decoding, pwd = pseudo-word decoding, rdg comp. = reading comprehension, F = French, E = English, rec. = receptive, exp. = expressive, voc. = vocabulary, rep. = repetition, mor. = morphology, Lnk = letter-name knowledge, RAN-o = rapid automatized naming-objects, RAN-n = rapid automatized naming-numbers, list. comp. = listening comprehension.

Table 3. Summary of linear regression analyses including K variables as predictors of L2 decoding and reading comprehension outcomes in the spring of grade 1

	Fall-K to spring-Gr 1						Spring-K to spring-Gr 1					
	Word		Pwd		Rdg comp.		Word		Pwd		Rdg comp.	
	Beta	*t*	Beta	*t*	Beta	*t*	Beta	*t*	Beta	*t*	Beta	*t*
K Predictor												
Rec. voc. (F)	.250	2.589[b]	.211	2.208[a]	.339 (.372)	4.429[c] (3.586[c])	.255	3.184[b]	.213	2.505[b]	.339 (.375)	5.278[c] (5.369[c])
Rec. voc. (E)	.064	.634	.078	.775	.051 (.353)	.600 (3.443[c])	.063	.773	.090	1.044	.120 (.211)	1.822 (3.056[b])
Pwd rep. (E)	.118	1.131	.080	.770	.029 (.081)	.329 (.696)	.006	.068	.068	.756	.039 (.004)	.561
Blending (E)	.166	1.551	.156	1.470	.341 (.378)	4.011[c] (3.690[c])	.516	6.247[c]	.503	5.729[c]	.588 (.580)	8.639[c] (8.302[c])
Exp. mor. (E)	.037	.353	−.010	−.100	−.055 (.031)	−.640 (.264)	.073	.899	.060	.693	.069 (.045)	1.022
Lnk (E)	.453	4.695[c]	.485	5.068[c]	.336 (.185)	3.625[c] (1.432)	.107	1.272	.165	1.857	.228 (.089)	3.371[c]
Word dec. (E)	.156	1.591	.134	1.369	.050 (.055)	.528 (.518)	.303	3.582[c]	.262	2.994[b]	.086 (.094)	1.217
RAN-o. (E) (RAN-n. [E])	−.138	−1.305	−.118	−1.120	−.233 (−.411)	−2.795[b] (−4.187[c])	−.152	−1.778	−.175	−1.926	−.195 (−.325)	−2.908[b] (−4.695[c])
Adjusted R^2	.225		.240		.523 (.425)		.461		.393		.653 (.655)	

Note. [a] $p < .05$, [b] $p < .01$, [c] $p \leq .001$; K = kindergarten, word = word decoding, pwd = pseudo-word decoding, rdg comp. = reading comprehension, Beta = standardized Beta, F = French, E = English, rec. = receptive, exp. = expressive, voc. = vocabulary, rep. = repetition, mor. = morphology, Lnk = letter-name knowledge, RAN-o = rapid automatized naming-objects, RAN-n = rapid automatized naming-numbers; numbers in parentheses refer to values obtained when RAN-ob. is replaced with RAN-num.

Grade 1 French word decoding

Fall-K predictors. The analysis revealed that scores on English letter-name knowledge (ß = .453, p = .000) and French receptive vocabulary (ß = .250, p = .011) were significant predictors of word decoding scores at the end of grade 1. These two predictors accounted for almost one quarter of the variance in test scores (R^2 = .244); F(2,82) = 13.216, p = .000.

Spring-K predictors. Results indicated that scores on English blending (ß = .516, p = .000), English word decoding (ß = .303, p = .000), and French receptive vocabulary (ß = .255, p = .002) were significant predictors of word decoding at the end of grade 1. These three predictors accounted for almost half of the variance in test scores (R^2 = .480), which was highly significant F(3,82) = 25.208, p = .000.

Grade 1 French pseudo-word decoding

The same predictor variables were entered in these analyses as were entered in the analyses of word decoding.

Fall-K predictors. The analysis revealed that scores on English letter-name knowledge (ß = .485, p = .000) and French receptive vocabulary (ß = .211, p = .030) were again the only significant predictors of pseudo-word decoding scores at the end of grade 1. These two predictors accounted for about one quarter of the variance in test scores (R^2 = .258), which was highly significant, F(2,82) = 14.238, p = .000.

Spring-K predictors. The analysis revealed that, similar to the spring-K prediction of grade 1 word decoding, English blending (ß = .503, p = .000) and English word decoding (ß = .262, p = .004) in the spring of K, and French receptive vocabulary (ß = .213, p = .014) in the fall of K were significant predictors of pseudo-word decoding one year later. These three predictors accounted for almost half of the variance in test scores (R^2 = .414), which was highly significant F(3,82) = 19.307, p = .000.

Grade 1 French reading comprehension

Fall-K predictors. The analysis revealed that scores on English letter-name knowledge (ß = .336, p = .001), French receptive vocabulary (ß = .339, p = .000), English blending (ß = .341, p = .000), and English rapid automatized naming of objects (ß = –.233, p = .006) at K entry were significant predictors of grade 1 French reading comprehension scores. These four predictors accounted for over half of the variance in test scores (R^2 = .546), which was highly significant F(4,80) = 24.062, p = .000.

An additional analysis was run in which English rapid automatized naming of objects was replaced by English rapid automatized naming of numbers in order to determine whether the nature of the task (lexical versus numeric) specifically was the determining factor. The result was that French receptive vocabulary (ß = .372, p = .001), English blending (ß = .378, p = .001), English rapid automatized naming of numbers (ß = –.411, p = .000), and English receptive vocabulary (ß = .353, p = .001) were the significant predictors of grade 1 French reading comprehension. These four predictors accounted for almost half of the variance in test scores (R^2 = .464), which was highly significant F(4,56) = 12.105, p = .000. These results suggest that there may be

something specific to rapid automatized access to lexical information that plays a significant role in reading comprehension since rapid automatized naming emerged significant in both analyses, but English receptive vocabulary emerged only in the second analysis when rapid automatized naming of objects was replaced by rapid automatized naming of numbers; the latter is arguably less language loaded than the former.

Spring-K predictors. The analysis revealed that English blending (ß = .588, p = .000), French receptive vocabulary (ß = .339, p = .000), English letter-name knowledge (ß = .228, p = .001), and English rapid automatized naming of objects (ß = –.195, p = .005) were significant predictors of reading comprehension one year later. These four predictors accounted for over 65 per cent of the variance in comprehension test scores (R^2 = .669), which was highly significant $F(4,81) = 41.014$, p = .000.

When English rapid automatized naming of objects was replaced by English rapid automatized naming of numbers, the significant predictors of grade 1 French reading comprehension were English blending (ß = .580, p = .000), French receptive vocabulary (ß = .375, p = .000), English rapid automatized naming of numbers (ß = –.325, p = .000), and English receptive vocabulary (ß = .211, p = .003). These four predictors accounted for over 65 per cent of the variance in test scores (R^2 = .673), which was highly significant $F(4,72) = 37.031$, p = .000. These results narrowly paralleled those of the analogous fall-K analysis.

For all regression analyses described here, it is noteworthy that the results remained identical when both age and non-verbal cognitive ability were added (step-wise) to the list of predictors or forced in before entering the other predictor variables. In addition, controlling for decoding ability in fall- and spring-K (i.e. forcing in word decoding ability before entering the other predictor variables step-wise in each linear regression analysis) also revealed very similar results, but in addition, the total variance accounted for was a few percentage points higher for every analysis and at each time point.

The Simple View of Reading applied to L2 reading acquisition

In the following analyses, we sought to examine whether the SVR is applicable to learning to read in an L2. It will be recalled that, according to the SVR, reading comprehension is equal to the product of decoding and language comprehension, measured concurrently with comprehension. Thus, we wanted to determine whether L2 oral language predictors played a significant unique role in predicting the L2 reading comprehension outcomes beyond that played by L2 literacy variables (i.e. decoding). If the answer is ‘yes’, then we also wanted to determine whether the relationship between the oral language and literacy variables that best predicts L2 reading comprehension is additive or multiplicative. See Table 2 for simple correlations between these variables and Table 4 for a summary of regression analyses results.

Step-wise regression analyses were carried out using grade 1 French listening comprehension (French CELF-Sentence Structure), grade 1 French pseudo-word decoding, and both the sum and the product of grade 1 French listening comprehension and grade 1 French pseudo-word decoding as predictors. Grade 1 French reading comprehension scores (mean of the sum of French word reading comprehension and French sentence reading comprehension z scores) were entered as the outcome variable. The regression revealed that, above and beyond the highly significant contribution of the grade 1 French pseudo-word decoding score (ß = .725, p = .000), the product of the grade 1 French pseudo-word decoding and grade 1 French listening comprehension scores was a significant (ß = –.262, p = .001) predictor of French reading comprehension. Together, grade 1

Table 4. Summary of linear regression analyses for simple view of reading components predicting L2 reading comprehension outcomes in the spring of grade 1

Grade 1 French predictor variable	Beta	*t*
Listening comprehension assessed via:	.102 (.009)	1.223 (.099)
French adaptation of CELF-4: Sentence Structure		
Pseudo-word decoding assessed via:	.725 (.771)	9.826[c] (11.059)[c]
WIAT-II[CDN]: Pseudoword decoding		
Listening comprehension + pseudo-word decoding	.165 (.015)	1.223 (.099)
Listening comprehension × pseudo-word decoding	–.262 (–.170)	–3.547[c] (–2.436)[a]
Adjusted R^2	.542 (.590)	
Grade 1 English predictor variable		
Listening comprehension assessed via:	.097	1.047
CELF-4 : Sentence Structure		
Pseudo-word decoding assessed via:	.533	5.779[c]
WJACH-III: Word Attack		
Listening comprehension + pseudo-word decoding	.144	1.047
Listening comprehension × pseudo-word decoding	.032	.338
Adjusted R^2	.276	

Note. [a] $p < .05$, [b] $p < .01$, [c] $p \leq .001$; Beta = standardized Beta; numbers in parentheses refer to values obtained when pseudo-word decoding is replaced with word decoding.

French pseudo-word decoding and the product of the grade 1 French pseudo-word decoding and grade 1 French listening comprehension scores accounted for over half of the variance in concurrent French reading comprehension test scores (R^2 = .553), which was highly significant $F(2,83) = 51.364$, $p = .000$. When the analyses were conducted using word decoding instead of pseudo-word decoding, the product of grade 1 French word decoding and grade 1 French listening comprehension was again a significant predictor (ß = –.190, $p = .017$) of French reading comprehension, above and beyond the highly significant contribution of the grade 1 French word decoding (ß = .742, $p = .000$), and the total amount of variance accounted for increased to 60 per cent (R^2 = .600), indicating that word decoding is a better predictor of reading comprehension than pseudo-word decoding.

The regression analyses were run a second time replacing French predictor measures with their English language equivalents in order to determine whether it was possible to concurrently predict French-L2 reading comprehension ability using English-L1 decoding and listening comprehension scores. More specifically, French WIAT-pseudo-word decoding subtest scores and French CELF-Sentence Structure subtest scores were replaced with grade 1 English Word Attack subtest scores from the WJACH-III and the English CELF-Sentence Structure subtest scores, respectively. Only pseudo-word decoding in English emerged as a significant concurrent predictor of French reading comprehension (ß = .533, $p = .000$), and the amount of variance accounted for decreased to 28 per cent (R^2 = .284), which was significant $F(1,84) = 33.393$, $p <.001$). However, these results suggest that the SVR does not apply cross-linguistically.

7. Discussion

The goals of the present study were to examine (1) the extent to which predictor measures of decoding and reading comprehension in monolingual English speakers would predict decoding and reading comprehension skills in English-speaking students who are learning to read in French

in an early immersion program; (2) how early in K significant cross-linguistic predictions would emerge – fall or spring of kindergarten; (3) whether oral language skills in French contribute significantly to predictions of variability in L2 reading outcomes; and (4) the generalizability of the Simple View of Reading to reading comprehension in a second language, both cross-linguistically and intra-linguistically.

Letter-sound knowledge in English and blending in English were found to be significant K predictors of word decoding in French at the end of grade 1. Similar results attesting to the importance of knowledge of the alphabetic principle and phonological awareness in learning to read have been well documented in both L1 and L2 reading research (August & Shanahan, 2006; Comeau et al., 1999; Genesee et al., 2006; National Reading Panel, 2000). We found that the same K variables were also significant predictors of pseudo-word decoding in grade 1. That the same predictors emerged for word and pseudo-word reading is probably due to the fact that these grade 1 immersion students were only beginning to read and, therefore, most printed words were unfamiliar and essentially equivalent to pseudo-words to them, rendering it unnecessary to call on a separate set of skills. In any case, these results indicate that letter-sound knowledge and blending are core decoding skills since they are implicated in reading words that the students have never seen before ('pseudowords') as well as real words.

Letter-name knowledge in English was a significant fall-K predictor whereas blending in English was a significant spring-K predictor, possibly owing to the greater ease that young children have in learning letter names as compared to blending sounds (see also Uhry & Clark, 2005, for a similar point of view). Moreover, the students may not have acquired blending skills sufficiently in the fall of K for there to be sufficient variance to predict later reading outcomes. Research has suggested that there may be a reciprocal relationship between phonological awareness and exposure to reading instruction (Castles & Coltheart, 2004; Hogan, Catts, & Little, 2005; Perfetti, Beck, Bell, & Hughes, 1987) and, thus, phonological awareness may not be as sensitive a predictor of word decoding in a second language as letter-sound knowledge when working with beginning level K immersion students. However, by the end of K, children in our study had had some formal literacy instruction and, arguably, had acquired more phonological awareness and, in particular, blending skills, at this stage.

Contrary to the findings of Jared et al. (2006), we found that knowledge of French, as measured by a receptive vocabulary test at school entry, was an additional significant predictor of decoding outcomes in grade 1, bringing the total variance accounted for to 24 per cent (word) and 26 per cent (pseudo-word) in the case of fall of K and 48 per cent (word) and 41 per cent (pseudoword), respectively, in the case of spring of K. That knowledge of French was a significant predictor of French-L2 decoding outcomes in the present study, but not in Jared and her colleagues' study, may not be surprising considering the relative proportion of individuals who speak French in Quebec (95%) and thus the greater variability in our participants' exposure to French in comparison to the situation in New Brunswick (10.58%) and Ontario (11.86%), the site of Jared's study (Statistics Canada, 2006). These results differ from those reported in studies of L1 reading acquisition where it has been found that, when regression analyses have been used to remove variance due to age, IQ, phonological awareness, and knowledge of the alphabetic principal, vocabulary is not a significant predictor of L1 decoding abilities (Byrne & Fielding-Barnsley, 1993; McGuinness, 2005). This discrepancy may be because most students in the L1 studies had acquired the requisite minimum vocabulary that underpins early reading acquisition in an L1, and there was insufficient variation in their vocabulary to account for variation in decoding. That receptive vocabulary emerged as a significant predictor in the present study suggests that oral language development, and especially oral vocabulary, is uniquely important for learning to read in a second language. Indeed, the

National Literacy Panel on Language-minority Children and Youth (August & Shanahan, 2006) arrived at a similar conclusion; namely, that although oral language does not contribute to decoding as strongly as phonological processing, its role is nonetheless an important one. By implication, systematic and direct vocabulary instruction is probably an important component of an early L2 reading instruction program.

With respect to reading comprehension, rapid automatized naming of objects in English along with letter-sound knowledge in English, English-blending, and French receptive vocabulary at K entry contributed significantly to the prediction of L2 reading comprehension at the end of grade 1. Overall, the fall and spring predictor tests predicted 52 per cent and 65 per cent, respectively, of the variance in reading comprehension in the spring of grade 1. Interestingly, when automatized naming of objects was replaced with automatized naming of numbers, English receptive vocabulary in fall-K emerged as a unique and significant predictor along with blending, knowledge of French at K entry, and RAN/RAS-numbers. That English receptive vocabulary became a significant predictor when rapid naming of familiar non-alphanumeric stimuli was replaced with rapid naming of familiar alphanumeric stimuli suggests that there is a unique and significant role played by a semantic component, in addition to the role played by speed of access to familiar phonological information per se, in predicting reading comprehension. This suggests that non-alphanumeric RAN may be tapping into oral language ability specifically. Indeed, while RAN has been found to correlate with reading in numerous studies, most studies have involved alphanumeric RAN or a combination of alphanumeric (e.g. numbers, letters) and non-alphanumeric (e.g. objects, colors) RAN. Furthermore, there is evidence to suggest that alphanumeric RAN correlates more closely with decoding than non-alphanumeric RAN (Schatschneider, Carlson, Francis, Foorman, & Fletcher, 2002; van den Bos, Zijlstra, & Spelberg, 2002; Wolf, 1986; but not Meyer, Wood, Hart, & Felton, 1998). That a test that is linked specifically to L1 oral language ability uniquely and significantly contributes to the prediction of L2 reading comprehension, but not to the prediction of L2 decoding, makes sense within a component processes framework of reading, such as the Simple View of Reading (Gough & Tunmer, 1986), a point we return to shortly. These results are consistent with Jared et al.'s (2006) insofar as they found that predictions of L2 decoding and reading comprehension differed in precisely the same manner – grammatical ability, an oral language task, was uniquely predictive of reading comprehension but not decoding.

As stated earlier, 22 per cent, 24 per cent, and 52 per cent of the variance in grade 1 French word decoding, pseudo-word decoding, and reading comprehension, respectively, was predicted on the basis of the fall-K predictors. This suggests that it is possible to identify risk for difficulty in L2 reading development in immersion students as early as the beginning of K using L1 predictor measures; this is especially evident from the reading comprehension results where 52 per cent of the variance was predicted. It follows, then, that important early intervention opportunities will be missed if it is assumed that the identification of immersion students who may be at-risk for reading difficulties should be delayed until they have acquired competence in oral French. At the same time, the predictive power of the K predictor variables examined increased substantially from fall to spring and, more specifically, from 23 per cent to 46 per cent for word decoding; from 24 per cent to 39 per cent for pseudo-word decoding; and from 52 per cent to 65 per cent for reading comprehension. This suggests that immersion students should be reassessed periodically to monitor their progress and risk status as instruction continues during K.

It is noteworthy that it was possible to predict almost twice as much variance in the grade 1 reading comprehension scores in comparison to the grade 1 decoding scores. To be more specific, using the fall-K predictors, about 25 per cent of variance in grade 1 word decoding was predicted while over 50 per cent of the variance in grade 1 reading comprehension scores was predicted. We

are continuing to monitor these students' reading acquisition in grades 2 and 3 to ascertain if these levels of prediction hold up. If the variance in reading comprehension outcomes in higher grades can be predicted to the same extent using K predictors as found by the end of grade 1, this would reinforce the value of early identification, even as early as fall of kindergarten.

A second goal of this study was to examine whether Gough and Tunmer's (1986) Simple View of Reading is applicable to learning to read in a second language and whether it can be applied cross-linguistically; that is whether L1 components predict L2 outcomes as predicted by the Simple View. Linear regression was used to examine this question. Specifically, we entered L2 listening comprehension, L2 pseudo-word decoding, the sum of these two, and the product of these two step-wise and found that both L2 pseudo-word decoding and the product of L2 listening comprehension and L2 pseudo-word decoding contributed significantly to the prediction of grade 1 L2 reading comprehension; together they accounted for 54 per cent of the variance in French reading comprehension. That the product of listening comprehension and decoding significantly contributed to the prediction, above and beyond the sum of these, indicates that there is indeed an interaction or multiplicative relationship between these two variables in relation to reading comprehension in a second language. However, we found no evidence that the SVR applies cross-linguistically; that is, using L1 predictors to predict L2 reading outcomes. The latter may be due to the fact that these immersion students probably had disproportionately strong English-L1 listening comprehension skills as compared to their English decoding skills, keeping in mind that these children have not received L1 decoding instruction. As result, the product of their English listening comprehension and decoding skills would have been very low and insufficient to predict their relatively strong French reading comprehension skills (i.e. predictors of the equation would carry too much weight in the case of both an additive and a multiplicative relationship). In any case, the present results, along with those reported by Chen and Vellutino (1997), Kirby and Savage (2008), Savage (2006), and Savage and Wolforth (2007), suggest that the multiplicative relationship between comprehension and decoding that the Simple View of Reading hypothesizes plays a critical role in reading comprehension and applies intra-linguistically. Be it in a first language or in a second language, it does not apply cross-linguistically. These results are best regarded as preliminary insofar as our participants were at the early stages of acquiring reading comprehension skills in French. Follow-up testing, when the students are in grade 2 and higher, will provide important cross-validation of these findings.

Evidence that the Simple View of Reading applies to learning to read in an L2 is important because this constitutes the first evidence that we know of concerning individual differences in reading comprehension among immersion students who learn to read initially in French. These results also contribute to our understanding of the predictors of reading comprehension skills in a second language in general, which at present is limited because the data-base on L2 reading comprehension is so sparse (August & Shanahan, 2006). Practically speaking, the present results argue for an integrated approach to reading instruction in which listening comprehension and general oral language skills along with decoding skills are part of a comprehensive program of reading instruction for second language learners.

In conclusion, we have reported evidence for a significant role for L1 reading-related and language-related abilities in the acquisition of reading skills in French as a second language. These results corroborate other short-term studies of L2 reading acquisition in French immersion students (Bournot-Trites & Denizot, 2005; Comeau et al., 1999; Deacon et al., 2007; Geva & Clifton, 1994; Jared et al., 2006; MacCoubrey et al., 2004; Tingley et al., 2004; also, see Genesee & Jared, 2008, for a review) and English language learners (August & Shanahan, 2006; Genesee et al., 2006). There is good evidence from these results to justify early identification of French immersion students

who might be at risk for later reading difficulties. Identification as early as fall of kindergarten is possible since the present evidence indicates that assessments of L1-related skills and knowledge in the fall of K are significant predictors of later L2 reading outcomes and of comprehension outcomes in particular. Our results with respect to comprehension, although preliminary, constitute the first examination of individual differences in the L2 reading comprehension skills of immersion students and are an important first step toward developing a coherent and integrated approach to L2 reading instruction with a scientific basis. The present results also argue for additional support for immersion students who are risk for difficulty acquiring reading skills in French that emphasize the same kinds of skills as are called for in L1 readers with difficulty; namely, letter-sound knowledge and phonological awareness. The present results suggest that immersion students who are at risk also need support in their oral language development and particularly vocabulary in the early stages and listening comprehension later.

This study has limitations, of course, not the least of which is the fact that a causal link cannot be established between our predictor and outcome variables as a result of the correlational nature of the study. Nonetheless, the present results provide sufficient justification for a follow-up study that involves intervention, which would serve to both validate the present findings and establish a causal link between our predictor variables and outcome measures. A second limitation is our relatively small sample size and the obvious statistical constraints that are associated with this. A useful adjunct to this study would be a control group of English-speaking students receiving instruction in English with whom we could confirm and validate our findings. While we have been recruiting such a control group, recruitment is ongoing due to a relatively much smaller proportion of children meeting our recruitment criteria (namely, being English dominant) who attend English-L1 programs in Quebec.

Acknowledgements

This research was supported in part by grants from the Social Sciences and Humanities Research Council and the Canadian Language and Literacy Research Network. We wish to thank the research assistants who assisted us with this project, especially Jane Emes and Vanitha Pillay. This research would not have been possible without the support of Riverside School Board administration, staff, students, and parents.

References

Abu-Rabia, S. (1997). Reading in Arabic orthography: The effect of vowels and context on reading accuracy of poor and skilled native Arabic readers in reading paragraphs, sentences, and isolated words. *Journal of Psycholinguistic Research, 26*(4), 465–482.

Altman, D.G. (1991). *Practical statistics for medical research*. London: Chapman & Hall.

Arab-Moghaddam, N., & Sénéchal, M. (2001). Orthographic and phonological processing skills in reading and spelling in Persian/English bilinguals. *International Journal of Behavioral Development, 25*(2), 140–147.

August, D., & Shanahan, T. (Eds.) (2006). *Developing literacy in second-language learners: Report of the national literacy panel on language-minority children and youth*. Mahwah, NJ: Erlbaum.

Bournot-Trites, M., & Denizot, I. (2005). *Conscience phonologique en immersion française au Canada*. Paper presented at the conference *1er Colloque International de Didactique Cognitive*, Toulouse, France.

Bowey, J. A. (1994). Phonological sensitivity in novice readers and non-readers. *Journal of Experimental Child Psychology, 58*(1), 134–159.

Bowey, J. A. (2005). Predicting individual differences in learning to read. In M. J. Snowling, & C. Hulme (Eds.) *The science of reading: A handbook*. Malden, MA: Blackwell.

Byrne, B. (1998). *The foundation of literacy: The child's acquisition of the alphabetic principle*. Hove: Psychology Press.

Byrne, B, & Fielding-Barnsley, R. (1993). Evaluation of a program to teach phonemic awareness to young children: A one-year follow-up. *Journal of Educational Psychology, 85*(1), 104–111.

Castles, A., & Coltheart, M. (2004). Is there a causal link from phonological awareness to success in learning to read? *Cognition, 91*(1), 77–111.

Catts, H. W., Gillespie, M., Leonard, L. B., Kail, R. V., & Miller, C. A. (2002). The role of speed of processing, rapid naming, and phonological awareness in reading achievement. *Journal of Learning Disabilities, 35*(6), 509–524.

Chen, R., & Vellutino, F. R. (1997). Prediction of reading ability: A cross-validation study of the Simple View of Reading. *Journal of Literacy Research, 29*(1), 1–24.

Comeau, L., Cormier, P., Grandmaison, É., & Lacroix, D. (1999). A longitudinal study of phonological processing skills in children learning to read in a second language. *Journal of Educational Psychology, 91*(1), 29–43.

Cormier, P., Desrochers, A., & Sénéchal, M. (2006). Validation et consistance interne d'une batterie de tests pour l'évaluation multidimensionnelle de la lecture en français. *Revue des sciences de l'éducation, 32*(1), 205–225.

Cornoldi, C., DeBeni, R., & Pazzaglia, F. (1996). Profiles of reading comprehension difficulties: An analysis of single cases. In C. Cornoldi, & J. Oakhill (Eds.), *Reading comprehension difficulties: Processes and intervention* (pp. 113–135). Mahwah, NJ: Lawrence Erlbaum.

DaFontoura, H. A., & Siegel, L. S. (1995). Reading, syntactic, and working memory skills of bilingual Portuguese–English Canadian children. *Reading and Writing: An Interdisciplinary Journal, 7*(1), 139–153.

Deacon, S. H., Wade-Woolley, L., & Kirby, J. (2007). Crossover: The role of morphological awareness in French immersion children's reading. *Developmental Psychology, 43*(3), 732–746.

Dunn, L. M., & Dunn, L. M. (1997). *Peabody Picture Vocabulary Test* (3rd edn). Circle Pines, MN: American Guidance Service.

Dunn, L. M., Thériault-Whalen, C. M., & Dunn, L. M. (1993). *Echelle de Vocabulaire en Images Peabody* [*Peabody Picture Vocabulary Test*]. Toronto: Psycan.

Gathercole, S. E., & Baddeley, A. D. (1996). *The Children's Test of Nonword Repetition*. London: The Psychological Corporation.

Genesee, F. (1978). A longitudinal evaluation of an early immersion program. *Canadian Journal of Education, 3*(4), 31–50.

Genesee, F. (2004). What do we know about bilingual education for majority language students? In T. K. Bhatia, & W. Ritchie (Eds.), *Handbook of bilingualism and multiculturalism* (pp. 547–576). Malden, MA: Blackwell.

Genesee, F. (2007). French immersion and at-risk students: A review of research evidence. *Canadian Modern Language Review, 63*(5), 654–687.

Genesee, F., & Jared, D. (2008). Literacy development in early French immersion programs. *Canadian Psychology, 49*(2), 140–147.

Genesee, F., Lindholm-Leary, K., Saunders, W. M., & Christian, D. (Eds.) (2006). *Educating English language learners: A synthesis of research evidence*. New York: Cambridge University Press.

Geva, E., & Clifton, S. (1994). The development of first and second language reading skills in early French immersion. *The Canadian Modern Language Review, 50*(4), 646–667.

Geva, E., Yaghoub Zadeh, Z., & Schuster, B. (2000). Understanding individual differences in word recognition skills of ESL children. *Annals of Dyslexia, 50*(1), 123–154.

Gottardo, A. (2002). The relationship between language and reading skills in bilingual Spanish–English speakers. *Topics in Language Disorders, 22*(5), 46–70.

Gough, P. B., & Tunmer, W. E. (1986). Decoding, reading and reading disability. *Remedial and Special Education 7*(1), 6–10.

Halsall, N. D., (1994). Attrition/retention of students in French immersion with particular emphasis on secondary school. *The Canadian Modern Language Review, 50*(2), 312–345.

Hogan, T. P., Catts, H. W., & Little, T. (2005). The relationship between phonological awareness and reading: Implications for the assessment of phonological awareness. *Language, Speech, and Hearing Services in Schools, 36*(4), 285–293.

Hogan, T. P., & Harris, R. (2004). *Reading development in first and second languages: The case of French immersion in an urban school district*. Paper presented at the 11th Annual Meeting of the Society for the Scientific Study of Reading, Amsterdam, Holland.

Hoover, W. E. and Gough, P. (1990). The Simple View of Reading. *Reading and Writing: An Interdisciplinary Journal, 2*(2), 127–160.

Jared, D., Cormier, P., Levy, B. A., & Wade-Woolley, L. (2006). *Becoming biliterate: A longitudinal investigation of reading growth in children in French immersion*. Paper presented at the Conference of the Canadian Language and Literacy Research Network, Charlottetown, PEI, 19 June.

Johnston, A. M., Barnes, M. A., & Desrochers, A. (2008). Reading comprehension: Developmental processes, individual differences, and interventions. *Canadian Psychology/Psychologie canadienne, 49*(2), 125–132.

Kirby, J. R., & Savage, R. S. (2008). Can the simple view deal with the complexities of reading? *Literacy, 42*(2), 75–82.

Lambert, W. E., & Tucker, G. R. (1972). *Bilingual education of children: The St. Lambert experiment*. Rowley, MA: Newbury House.

MacCoubrey, S. J., Wade-Woolley, L., Klinger, D., & Kirby, J. R. (2004). Early identification of at-risk L2 readers. *The Canadian Modern Language Review, 61*(1), 11–28.

McGuinness, D. (2005). *Language Development and Learning to Read: The Scientific Study of How Language Development Affects Reading Skill*. Cambridge, MA: The MIT Press.

Meyer, M. S., Wood, F. B., Hart, L. A., & Felton, R. H. (1998). Longitudinal course of rapid naming in disabled and nondisabled readers. *Annals of Dyslexia, 48*(1), 89–114.

Muter, V., & Diethelm, K. (2001). The contribution of phonological skills and letter knowledge to early reading development in a multilingual population. *Language Learning, 51*(2), 187–219.

Muter, V., Hulme, C., Snowling, M. J., & Stevenson, J. (2004). Phonemes, rimes and language skills as foundations of early reading development: Evidence from a longitudinal study. *Developmental Psychology, 40*, 663–681.

National Early Literacy Panel (2008). *Developing early literacy: Report of the National Early Literacy Panel*. Washington, DC: National Institute for Literacy.

National Reading Panel (2000). *Report of the National Reading Panel. Teaching children to read: An evidence-based assessment of the scientific research literature on reading and its implications for reading instruction*. Washington, DC: US Department of Health and Human Services.

Oakhill, J., Cain, K., & Bryant, P. E. (2003). The dissociation of word reading and text comprehension: Evidence from component skills. *Language and Cognitive Processes, 18*(4), 443–468.

Obadia, A., & Thériault, C. M. L. (1997). Attrition in French immersion programs: Possible solutions. *The Canadian Modern Language Review, 53*(3), 506–529.

Parkin, P., Morrison, F., & Watkin, G. (1987). *French immersion research relevant to decisions in Ontario*. Toronto: OISE. (Ontario Institute for Studies in Education).

Perfetti, C. A., Beck, I., Bell, L., & Hughes, C. (1987). Phonemic knowledge and learning to read are reciprocal: A longitudinal study of first grade children. *Merrill-Palmer Quarterly, 33*(3), 283–319.

Purvis, K. L., & Tannock, R. (2000). Phonological processing, not inhibitory control, differentiates ADHD and reading disability. *Journal of the American Academy of Child and Adolescent Psychiatry, 39*(4), 485–494.

Quiroga, T., Lemos-Britton, Z., Mostafapour, E., Abbott, R., & Berninger, V. W. (2002). Phonological awareness and beginning reading in Spanish-speaking ESL first graders: Research into practice. *Journal of School Psychology, 40*(1), 85–111.

Raven, J., Raven, J. C., & Court, J. H. (1998). *Coloured Progressive Matrices* (1998 edn). Oxford: Oxford Psychologists Press.

Rice, M., & Wexler, K. (2001). *Test of early grammatical impairment*. New York: The Psychological Corporation.

Sattler, J. (1988). *Assessment of children's intelligence and other special abilities* (3rd edn). San Diego, CA: Jerome Sattler.

Savage, R. S. (2006). Reading comprehension is not always the product of decoding and listening comprehension: evidence from teenagers who are very poor readers. *Scientific Studies of Reading, 10*(2), 143–164.

Savage, R. S., & Frederickson, N. (2005). Evidence of a highly specific relationship between rapid automatic naming of digits and text-reading speed. *Brain and Language, 93*(2) 152–159.

Savage, R. S., & Wolforth, J. (2007). How well does the component model of reading predict performance of university students with learning disabilities? *Exceptionality Education Canada, 17*(2), 243–268.

Scanlon, D. M., Anderson, K. L., & Flynn, L. H. (2008). *Preventing reading difficulties: The role of instruction and experience before first grade*. Presentation for the Early Childhood Direction Center, Capital Region Board of Cooperative Educational Services, Latham, NY.

Scanlon, D. M., Gelzheiser, L. M., Vellutino, F. R., Schatschneider, C., & Sweeney, J. M. (2008). Reducing the incidence of early reading difficulties: Professional development for classroom teachers vs. direct interventions for children. *Learning and Individual Differences, 18*(4), 346–359.

Schatschneider, C., Carlson, C. D., Francis, D. J., Foorman, B. R., & Fletcher, J. M. (2002) Relationship of rapid automatized naming and phonological awareness in early reading development: Implications for the double deficit hypothesis. *Journal of Learning Disabilities, 35*(3), 245–256.

Schatschneider, C., Fletcher, J. M., Francis, D. J., Carlson, C., & Foorman, B. R. (2004) Kindergarten prediction of reading skills: A longitudinal comparative analysis. *Journal of Educational Psychology, 96*(2), 265–282.

Semel, E., Wiig, E. H., & Secord, W. A. (2003). *Clinical Evaluation of Language Fundamentals* (4th edn). New York: The Psychological Corporation.

Statistics Canada (2006). Census of population, Statistics Canada. URL (accessed 27 July 2010): http://www40.statcan.ca/l01/cst01/demo11b-eng.htm. Catalogue no. 97-555-XCB2006015 (retrieved 11 June 2008).

Storch, S. A., & Whitehurst, G. J. (2002). Oral language and code-related precursors to reading: Evidence from a longitudinal structural model. *Developmental Psychology, 38*(6), 934–947.

Swain, M., & Lapkin, S. (1982). *Evaluating bilingual education: A Canadian case study*. Clevedon: Multilingual Matters.

Tingley, P. A., Dore, K. A., Lopez, A., Parsons, H., Campbell, E., Kay-Raining Bird, E., & Cleave, P. (2004). A comparison of phonological awareness skills in early French immersion and English children. *Journal of Psycholinguistic Research, 33*(3), 263–287.

Uhry, J. K., & Clark, D. B. (2005). *Dyslexia: Theory and practice of instruction* (3rd edn). Baltimore, MD: York Press.

Van den Bos, K. P., Zijlstra, B. J. H., & Spelberg, H. C. I. (2002). Life-span data on continuous naming speeds of numbers, letters, colors, and pictured objects, and word-reading speed. *Scientific Studies of Reading, 6*(1), 25–49.

Wagner, R. K., & Torgesen, J. K. (1987). The nature of phonological processing and its causal role in the acquisition of reading skills. *Psychological Bulletin, 101*(2), 192–212.

Wechsler, D. (2005). *Wechsler Individual Achievement Test* (2nd edn, Canadian). Toronto, Ontario: Pearson Canada Assessment.

Wilkinson, G. S. (1993). *Wide Range Achievement Test* (3rd edn). Wilmington, DE: Wide Range.

Wolf, M. (1986). Rapid alternating stimulus naming in the developmental dyslexias. *Brain and Language, 27*(2), 360–379.

Wolf, M., & Denckla, M. B. (2005). *Rapid automatized naming and rapid alternating stimulus tests*. Austin, TX: Pro-Ed.

Woodcock, R. W., McGrew, K. S., & Mather, N. (2001). *Woodcock-Johnson III tests of achievement (WJ III ACH)*. Itasca, IL: Riverside Publishing.