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A school-based phonological awareness intervention for struggling readers in early French immersion

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Abstract The current intervention study investigated the sustained effectiveness of phonological awareness training on the reading development of 16 children in French immersion who were identified as at-risk readers based on grade 1 English measures. The intervention program provided children from three cohorts with supplemental reading in small groups on a withdrawal basis. Children in the experimental group ($n = 5$) received English phonological awareness training in combination with letter-sound correspondence instruction twice per week for 18 consecutive weeks, while those in the control condition ($n = 7$) engaged in English vocabulary-building activities. Significant gains were made after the training and maintained for 2 years on both French phonological awareness and French word reading skills for the experimental group. Results suggest that a phonologically based intervention in English can effectively address phonological awareness deficits and facilitate reading acquisition for French immersion children who may be at-risk for later reading difficulties.

Keywords Phonological awareness · French immersion · Early intervention · Early identification · Reading achievement

Introduction

Considerable research evidence has established that early identification and instructional intervention is key for the remediation and prevention of later reading difficulties (National Reading Panel, 2000; Schneider, Roth, & Ennemoser, 2000; Wise & Chen, 2009). In recent years, preliminary evidence has shown that children

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in French immersion programs who are struggling with reading acquisition can benefit from early identification and the provision of timely phonological awareness instruction (Bournot-Trites, 2008; Geva, 2006; MacCoubrey, 2003; Wise & Chen, 2010). French immersion is a nationwide, publicly funded educational program in Canada that promotes the French language acquisition of non-francophone children. French is the sole medium of classroom instruction in the early grades, whereas children speak English or another language at home. Because French immersion teachers typically choose to focus on oral language rather than reading skills in the first couple of years of the program, children who experience difficulty with reading acquisition are often not identified as struggling readers until grade 2 or 3 (Keep, 1993), and therefore, miss out on critically important early intervention opportunities (MacCoubrey, Wade-Woolley, Klinger, & Kirby, 2004). The aim of the current intervention study was to investigate the sustained effectiveness of a phonological awareness reading intervention, provided in English, for grade 1 struggling readers enrolled in an early French immersion program.

Struggling readers in French immersion

The French immersion program in Canada was initially created in response to the demands of predominantly English-speaking parents who wanted their children to develop language and literacy skills in both English and French (Lambert & Tucker, 1972). Although the French immersion program has enjoyed increasing popularity for more than 45 years, it has also faced the criticism of catering to only the highest achievers (Mady & Arnett, 2009; Safty, 1992). Relatedly, special education services are often not provided within the French immersion school system (Genesee, 2007; Genesee & Jared, 2008; Mady & Arnett, 2009; Wise, 2011) and struggling readers are advised to transfer to the regular English stream to access support (Cummins, 1984; Stern, 1991). While children from English-speaking families have traditionally attended French immersion programs, there has been a steady increase in the enrolment of children who are English language learners in recent years (Swain & Lapkin, 2005).

Generally speaking, children who enrol in early French immersion, which begins in senior kindergarten or grade 1, have little to no French language background. As a result, teachers rarely initiate formal reading instruction until after their students have acquired oral proficiency in French, the target language. At the beginning of the school year, the focus is on developing children's oral language skills in French (e.g., listening and speaking). Classroom teachers expect that children will be able to follow through on simple verbal instructions and express their basic needs in French after being immersed in the language. However, without reading risk assessment at an early stage in their literacy development, children who experience difficulty with the acquisition of reading skills are often not identified as struggling readers until grades 2 or 3 (Keep, 1993).

Although extensive research has indicated that children who struggle with reading acquisition could become proficient readers if appropriate reading interventions were provided early on in the immersion context (Cummins, 1984; Genesee, 2007), struggling readers in French immersion programs are typically not

identified in the early stage of reading development due to the initial focus on oral language proficiency (Genesee & Jared, 2008; MacCoubrey et al., 2004; Mady & Arnett, 2009; Parkin, Morrison, & Watkin, 1987). Once these children begin to demonstrate signs of reading disabilities, often not until grade 2 or later when the instructional focus switches to literacy, they are encouraged to switch to the English-stream program to access support services (Stern, 1991). Students who transfer out of French immersion programs, however, lose the chance to become functionally bilingual in French and English and forego many of the advantages of a bilingual education (Mannavarayan, 2002). In an effort to address this concern, the present study aimed to investigate the effectiveness of a phonological awareness intervention for children enrolled in an early total French immersion program who were identified immediately upon entry as being the lowest achievers on measures of reading skills.

Phonologically based interventions in French immersion

The use of phonological awareness to predict later reading ability has been a focus of first language educational research for many decades (Adams, 1990; Ehri et al., 2001; Nicholson, 1997; Snow, Burns, & Griffin, 1998; Stanovich, 2000). Phonological awareness, the ability to attend to, isolate, and manipulate the sound structure of oral language at the level of syllables, onset-rimes, and phonemes (Wagner, Torgesen & Rashotte, 1999), develops sequentially and is a robust predictor of later reading achievement among young children. Phonemic awareness refers to the ability to identify and manipulate individual sounds in words, and is the ultimate goal of most instructional programs (Robertson & Salter, 2007). There is an abundance of evidence linking phonological awareness training and reading achievement, particularly when the focus of the instruction is phonemic awareness (Expert Panel on Literacy & Numeracy Instruction, 2005). According to the meta-analysis conducted by the National Reading Panel (2000), children who received instruction that focused on one or two advanced phonological awareness skills (i.e., phoneme segmentation and blending) performed better on outcome measures of phonological awareness and reading than those who were provided with multiple-skill phonological awareness instruction (i.e., phoneme isolation, identification, categorization, blending, segmentation, and deletion). Additionally, phonological awareness training that focuses on phoneme segmentation and blending has been found to produce the greatest gains when it is provided in conjunction with letter-sound correspondence instruction (e.g., Schneider et al., 2000).

Numerous investigations involving bilingual early readers have shown that phonological awareness in a child's first (L1) or second (L2) language is closely linked to both phonological awareness and reading achievement in another language (Comeau et al., 1999; Durgunoğlu, Nagy, & Hancin-Bhatt, 1993). Durgunoğlu et al., (1993) found that in a sample of grade 1 native Spanish speakers learning English as an L2, phonological processing skills in both L1 and L2 correlated with L2 word reading. Subsequent studies have confirmed that phonological awareness is consistently related to L2 word reading and is a strong predictor of L1 and L2 word reading ability (Comeau et al., 1999; Durgunoğlu, 2002; Lindsey, Manis, &

Bailey, 2003). In a study of French immersion children in grades 1, 3, and 5, Comeau et al. (1999) found that L1 English phonological awareness was significantly related to English and French reading achievement a year later. Similarly, MacCoubrey et al. (2004) found that L1 English tests of phonological awareness administered to grade 1 French immersion children distinguished between good and poor readers in both English and French in grade 2. These findings indicate that it may not be necessary to delay reading intervention for French immersion children due to their initial low level of French oral language proficiency. Rather, such cross-language relationships provide a strong basis for the use of English for phonological awareness training, which is designed to alleviate those problems.

Despite these important findings, few phonemic awareness intervention studies involving struggling readers in the early immersion context have been reported in the literature. One noteworthy exception was MacCoubrey (2003), who demonstrated the effectiveness of a 12-week phonological awareness intervention for English-speaking monolingual kindergarten children in French immersion. The experimental group ($n = 26$) received French phonemic awareness training, and the comparison group ($n = 23$) engaged in French vocabulary-building activities. Following intervention, children in the experimental group received significantly higher scores on phonological awareness in both French and English when compared to the comparison group; however, no significant effect was reported for French word reading skills. One possible explanation for the latter finding was that formal literacy instruction had not yet been initiated in the kindergarten classrooms. The present investigation extends MacCoubrey's (2003) study by evaluating the effectiveness of English phonological awareness training for grade 1 French immersion children who were receiving daily reading instruction.

The present study

The current study extends previous intervention research by examining the effectiveness of an 18-week small group phonological awareness intervention on reading achievement in grade 1 French immersion struggling readers. The intervention combined phonological awareness training and letter-sound correspondence instruction and was initiated at the beginning of the school year, immediately following the administration of English pre-test measures. Given the participants' lack of French language proficiency when the intervention was initiated, instruction was provided solely in English. Based upon the overwhelming research evidence in support of early identification and intervention for children who are at-risk for later reading difficulties (e.g., National Reading Panel, 2000), we anticipated that systematic and explicit phonological awareness training would improve the French reading achievement of children who had met the criteria for inclusion in the experimental group. An important feature of this intervention cohort study was that it involved a teacher-delivered instructional intervention in a natural French immersion school setting. We also reassessed the children's English and French phonological awareness and word reading skills for 3 years after the intervention, to monitor progress and the sustainability of treatment effects.

Methods

Participants

The children who participated in this study were enrolled in a publicly funded, single-track French immersion elementary school in a middle- to upper-middle class neighbourhood located on the outskirts of a large, multicultural city. A total of 252 children (M_{age} = 75 months, SD = 3.58; 124 females) from three different cohorts were assessed at pre-test in the fall of grade 1 using English measures to identify students who were struggling to acquire early reading skills immediately upon entry into the immersion program. Although most of the participants had been born in Canada, only 34.5 % came from homes in which English was the primary language spoken.[1] Of the 252 participants, 89 children were in cohort 1, 88 in cohort 2, and 75 in cohort 3. The three cohorts did not differ significantly from each other in terms of demographic characteristics, nonverbal reasoning, and English grade 1 pre-test measures.

Participants were identified as at-risk for later reading difficulties on the basis of their fall of grade 1 pre-test performance on English measures of phonological awareness and word reading. Children who met the criteria for the intervention scored at or below the 30th percentile on English phonological awareness and English word reading. Although there is considerable debate in the literature as to how reading achievement should be defined, the 30th percentile has been a suggested criterion when determining students' successful performance on achievement measures (Torgesen, 2000) and has been used as an indication of risk status in recent reading investigations (e.g., Simmons et al., 2008; Vellutino, Scanlon, Zhang, & Schatschneider, 2008) and reading intervention studies (O'Connor, Jenkins, & Slocum, 1995). Altogether, 16 struggling readers were identified across the three cohorts and over a three-year period. Permission to participate was obtained for the 16 children in each year of the study. Those children who scored above the 30th percentile on both English elision and English word reading were considered to be typically developing readers.

Of the 16 at-risk readers, four children withdrew from the French immersion program and transferred to an English-mainstream program before the study was complete. There were no statistical differences between the children who left the study and the children who participated in the entire study. The final sample consisted of 12 children (9 females) who participated in each wave of the study and had been assigned to an experimental (n = 5) or control (n = 7) group in grade 1. Two out of 12 children identified as English-speaking monolinguals. The remaining students (n = 10) were from diverse linguistic backgrounds. The languages represented in this group included: Cantonese (n = 1), Turkish (n = 1), Hebrew (n = 3), and Russian (n = 5).

[1] In order for children to be classified as English-speaking monolingual, parents had to indicate that English was spoken in the home environment 50 % of the time or more.

Intervention and instruction

In each cohort year, struggling readers who had been identified were provided with small group instruction twice per week for 18 consecutive weeks, beginning in early December. The identified at-risk readers were assigned to the experimental and control conditions following a randomized block design to control for classroom effect. That is, for each class, half of the at-risk readers were randomly assigned to the experimental condition, whereas the other half were randomly assigned to the control condition. Several classes had only one at-risk reader each and these classes were then randomly assigned to the two conditions. Each instructional session was provided to a group of three to four students and lasted approximately 25 min. The struggling readers in both the experimental and control conditions received instruction solely in English.

Phonological awareness training

The experimental group was provided with phonological awareness training in combination with letter-sound correspondence instruction. In light of the educational research indicating that phonological awareness skills typically develop in a particular sequence (Hodson, 2002), the students received instruction designed to increase their phonological awareness skills in a systematic manner. Over the course of the training, they became cognizant of the fact that sentences are made up of words, words are made up of syllables, and syllables are made up of individual sounds or phonemes. This progression increased the children's awareness of increasingly smaller units of speech, and over time, they learned to produce and manipulate them. Despite the commercial availability of instructional materials that teach phonological awareness skills in isolation, our phonological awareness training was deliberately linked to children's literature in order to create *contextualized literacy experiences* (McGee & Richgels, 2000). Readily available materials that teach phonological awareness skills in isolation are frequently criticized for failing to provide sufficient motivation for young learners. In contrast, utilizing a variety of popular children's stories allowed learning to take place in a more meaningful and authentic manner. Over the course of the 18 weeks, instructional activities at the word, syllable, and phoneme level involved vocabulary found in these texts. Each week, the examiner read aloud a new story to the children in their groups. In total, the students in the experimental group received 15 h of explicit phonological awareness instruction, a period of time considered to be effective for facilitating reading achievement (National Reading Panel, 2000). Phonemic awareness was the ultimate goal of the phonological awareness training; consequently, 10 of the 18 weeks of the intervention focused on phonemic awareness instruction. More information about the intervention can be found in Wise and Chen (2015).

Vocabulary training (control)

The struggling readers in the control group were provided with an alternate intervention, which focused on vocabulary instruction. The children in this condition were also taught in small groups by the same examiner and received

the same amount of instructional time as those in the experimental group. The same texts were utilized for instructional purposes, and they were read aloud in the same order to ensure that the treatment effects were solely attributable to the phonological awareness training, rather than to the novelty of the experimental intervention. Children took part in vocabulary-building activities involving words that were taken directly from the stories that the instructor read orally. In order to enhance the children's understanding of the new vocabulary, text illustrations were highlighted as the stories were read aloud. To help the children in the control group make sense of the new vocabulary that was being introduced in this literary context, the experimenter encouraged them to draw upon their prior knowledge and experience during these discussions.

Treatment fidelity

Fidelity checks were completed at regular intervals by research assistants and school personnel to avoid instructional drift and ensure that experimental and control conditions were being faithfully implemented (Troia, 1999). Checklists were completed in each cohort year, while the experimenter was delivering instruction to the students in both conditions. This procedure makes it possible to report percent accurate implementation at the conclusion of the study (Troia, 1999). Results of the 62 fidelity checklists completed over the course of the 3-year investigation indicated 94 % accurate implementation of experimental and control conditions.

Assessment

Children in the experimental and control groups from each cohort were assessed at four time points: pre-test (fall of grade 1), post-test (spring of grade 1), delayed post-test (spring of grade 2), and follow-up (spring of grade 3). Typically developing readers were assessed at pre- and post-test only due to budgetary constraints.

(a) Pre-test: English measures only. The pre-test consisted of nonverbal reasoning, word reading, and phonological awareness. This data served as a baseline of English proficiency before children began acquiring French language and literacy skills through instruction.
(b) Post-test: English and French measures of phonological awareness and word reading.
(c) Delayed post-test and follow-up: The delayed post-test and follow-up were the same as the post-test.

Nonverbal reasoning

Nonverbal reasoning was assessed once at pre-test in grade 1 using the Matrix Analogies Test (expanded form; Naglieri, 1985). Each student was asked to view a visual pattern with a missing portion in order to determine which of six possible pieces would best fit the pattern. Test administration involved the presentation of 64

such patterns, which were organized into four subtests containing 16 test items each. For each subtest, testing was discontinued after the student made four consecutive errors.

English phonological awareness

Two subtests of the Comprehensive Test of Phonological Processing (CTOPP; Wagner et al., 1999) were used to measured English phonological awareness: elision and blending words. Each subtest had six practice items and 20 test items, and testing was discontinued as soon as three consecutive errors were made on the test items. On the elision subtest, students were encouraged to listen to individual words read aloud by the examiner. Next, they were asked to delete a word part or sound in each word that had been presented (e.g., "say *sunshine* without saying *sun*" or "say *blend* without saying/*l*/"). On the blending words subtest, children were asked to listen to parts of words or individual sounds in words and put the word parts or sounds together to form whole words (e.g., *cup* + *cake* or/*b*//*ă*//*d*/). English elision was administered at each time point and the English blending words subtest was administered at pre-test, post-test, and follow-up.

French phonological awareness

Two French experimental measures of phonological awareness that had been previously constructed and used by MacCoubrey (2003) were modified for the present investigation. These tasks were similar in design to the two English phonological awareness subtests described above. Both the elision and blending words tests contained six practice items and 20 test items and the tasks were discontinued when children made three consecutive errors on the test items. The French elision test was administered at post-test, delayed post-test, and follow-up. French blending words was administered at post-test and follow-up.

English word reading

Word reading in English was assessed by the Letter-Word Identification subtest from the Test of Achievement, Woodcock Johnson-III (WJ-III; Woodcock, McGrew, & Mather, 2001). Children were asked to read a series of 76 letters (e.g., "point to the letter L") and words (e.g., *is, which, together*) that were presented in order of increasing difficulty. The test was discontinued after six consecutive errors on a page. This task was administered at each time point.

French word reading

A French word reading experimental task that had been previously developed and administered by MacCoubrey (2003) was modified for the present investigation. The test included a total of 120 items that were arranged in sets of eight words. Level of word difficulty increased as children progressed across each set. The task

was discontinued at the end of a set when the child had made 4 or more errors. French word reading was administered from post-test to follow-up.

Procedure

Participants were tested in a quiet room at the school. Trained undergraduate and graduate research assistants, who were fluent in the respective test language and blind to the intervention conditions, individually administered English and French measures in two separate sessions that lasted approximately 30 min each. The order of the sessions was counterbalanced across participants and within each session the order of task administration was randomized. To ensure understanding, both French and English instructions were given prior to administration of French measures.

Results

Tables 1 and 2 summarize the descriptive statistics of the English and French measures for the experimental and control groups at each time point. Coefficient reliabilities are reported for each measure and group across the four time points. To assess possible differences between the experimental and control group prior to the intervention, independent samples *t* tests on English pre-test measures were conducted. The children in the experimental and control groups did not differ significantly on nonverbal reasoning and English pre-test measures, and therefore, had equivalent scores at baseline.

Immediate treatment effects on English and French measures

To investigate whether the experimental group made progress in English phonological awareness and English word reading skills immediately after receiving the intervention, we conducted 2 (condition: experimental vs. control) × 2 (time: pre-test vs. post-test) mixed analysis of variance (ANOVA) models for English elision, English blending words, and English word reading scores.[2] Separate *t* tests were conducted to follow-up significant interactions.[3]

English phonological awareness

There was a significant main effect in English elision scores between pre- and post-test, $F(1, 14) = 50.32$, $p < .001$, $\eta\rho^2 = 0.78$, and a significant difference between the training groups, $F(1, 14) = 7.21$, $p = .02$, $\eta\rho^2 = 0.34$. There was also a significant interaction effect in elision scores between the pre- and post-test results

[2] Partial eta squared, $\eta\rho^2$, was used to report the effect size of significant ANOVA results (values greater than .50 = large). Similarly, Cohen's *d* was used to compare effect sizes of *t* tests (values greater than .80 = large).

[3] Due to the small group size, equivalent non-parametric tests were calculated for each analysis. Mann–Whitney's *U*, Kruskal–Wallis, Friedman, and Wilcoxon Signed Rank tests confirmed our parametric results. .

Table 1 Means, standard deviations, and reliabilities for the experimental (n = 5), Control (n = 7), and typically developing (n = 75) groups at pre- and post-test

Measure	Pre-test				Post-test			
	α	Experimental *M* (*SD*)	Control *M* (*SD*)	Typically developing *M* (*SD*)	α	Experimental *M* (*SD*)	Control *M* (*SD*)	Typically developing *M* (*SD*)
Nonverbal reasoning	0.89	13.80 (7.62)	12.14 (8.09)	21.48 (12.35)		–	–	–
English elision	0.85	2.20 (1.30)	2.29 (0.49)	10.91 (5.07)	0.91	10.00 (4.80)	4.71 (1.98)	12.73 (4.97)
English blending words	0.58	6.40 (1.67)	6.14 (1.77)	12.24 (3.52)	0.84	13.00 (2.92)	7.71 (3.77)	–
English word reading	0.93	19.20 (10.18)	17.43 (6.13)	35.55 (9.77)	0.95	23.40 (11.97)	20.14 (3.85)	38.88 (9.47)
French elision	–	–	–	–	0.94	9.20 (6.00)	6.86 (1.46)	12.87 (5.83)
French blending words	–	–	–	–	0.76	10.20 (1.30)	10.00 (2.83)	–
French word reading	–	–	–	–	0.98	37.00 (20.63)	13.00 (11.26)	43.20 (12.80)

α = Cronbach's alpha

Table 2 Means, standard deviations, and reliabilities for the experimental (n = 5) and control (n = 7) groups at delayed post-test and follow-up

Measure	Delayed post-test			Follow-up		
	α	Experimental *M* (*SD*)	Control *M* (*SD*)	α	Experimental *M* (*SD*)	Control *M* (*SD*)
English elision	0.66	11.60 (4.72)	8.71 (3.68)	0.92	14.00 (6.44)	9.29 (3.40)
English blending words	–	–	–	0.67	12.60 (2.19)	11.29 (2.22)
English word reading	0.93	38.00 (12.15)	29.14 (4.71)	0.83	47.00 (8.40)	36.86 (6.96)
French elision	0.92	11.80 (5.07)	8.14 (5.21)	0.93	18.40 (6.35)	6.71 (2.50)
French blending words	0.96	–	–	0.96	15.60 (1.52)	11.86 (1.46)
French word reading	0.98	76.80 (30.59)	36.86 (13.59)	0.99	95.80 (8.76)	47.29 (8.60)

α = Cronbach's alpha

Table 3 Pairwise comparisons for the experimental (n = 5), control (n = 7), and typically developing (n = 75) groups at post-test (Grade 1) and for the experimental and control groups at follow-up (Grade 3)

Measure	Comparison	Mean difference	95 % confidence interval	
			Lower	Upper
Post-test Grade 1: immediate effects				
English elision	E > C*	2.50	0.50	4.50
	C < TD***	−8.03	−11.91	−4.15
English word reading	C < TD***	−20.08	−27.59	−12.57
	E < TD***	−15.88	−25.35	−6.41
French elision	C < TD***	−6.27	−8.22	−4.31
French word reading	E > C*	23.40	3.78	43.02
	C < TD***	−30.60	−40.77	−20.43
Follow-up Grade 3: Delayed effects				
English word reading	E > C*	10.14	0.27	20.02
French elision	E > C**	5.90	2.47	9.32
French word reading	E > C***	30.57	16.18	45.03

A Bonferroni correction was applied for multiple comparisons

E experimental group, *C* control group, *TD* typically developing readers

* $p < .05$; ** $p < .01$; *** $p < .001$

and the type of training the children received, $F(1, 14) = 13.77$, $p = .002$, $\eta\rho^2 = 0.50$. Further analysis revealed that children in the experimental group made significantly higher gains than the control group on English elision scores at post-test, $t(14) = 2.73$, $p = .03$, $d = 1.51$, 95 % CI [0.50, 4.50]. There was no significant difference in English blending word scores for the two training groups, $F(1, 14) = 3.98$, $p = .07$. However, there was a significant difference in blending word scores between pre- and post-test, $F(1, 14) = 17.89$, $p < .001$, $\eta\rho^2 = 0.56$, and a significant interaction effect between pre- and post-test results and the type of training children received, $F(1, 14) = 6.18$, $p = .03$, $\eta\rho^2 = 0.31$. Follow-up

paired-sample t tests revealed that there was a significant increase in blending word scores between pre- and post-test for children in the experimental group, $t(5) = -4.01$, $p = .03$, but not for the control group, $t(9) = -1.47$, $p = .18$.

English word reading

There was no significant difference in English word reading for the two training groups, $F(1, 14) = 0.67$, $p = .48$. Results showed a significant difference between word reading at pre- and post-test, $F(1, 14) = 12.32$, $p = .003$, $\eta\rho^2 = 0.47$. No significant interaction effect was observed between the time of testing and the type of training children received, $F(1, 14) = 0.67$, $p = .48$. Because the children did not receive French language and literacy measures at pre-test, independent samples t tests were used to evaluate group differences in French phonological awareness and French word reading immediately following the phonological awareness intervention.

French phonological awareness

There were no differences between children in the two training groups in French elision, $t(14) = 1.77$, $p = .13$, $d = 1.01$, and French blending words, $t(14) = .54$, $p = .60$, $d = 0.26$, at post-test.

French word reading

Results revealed significant differences between the experimental and control groups in French word reading scores at post-test, $t(14) = 2.83$, $p = .03$, $d = 1.56$, 95 % CI [3.78, 43.02].

Delayed treatment effects on English and French measures

To investigate whether gains made by the experimental and control groups were maintained at follow-up testing in the spring of grade 3, we conducted 2 (condition: treatment vs. control) × 4 (time: pre-test vs. post-test vs. delayed post-test vs. follow-up) mixed-model ANOVAs for English elision and English word reading scores, a 2 (condition: treatment vs. control) × 3 (time: pre-test vs. post-test vs. follow-up) mixed-model ANOVA for English blending words, 2 (condition: treatment vs. control) × 3 (time: post-test vs. delayed post-test vs. follow-up) mixed-model ANOVAs for French elision and French word reading scores, and a 2 (condition: treatment vs. control) × 2 (time: post-test vs. follow-up) mixed-model ANOVA for French blending words. Separate t tests were conducted to follow-up significant interactions and the results are presented in the lower panel of Table 3.

English phonological awareness

The results revealed no significant difference in English elision scores between the two training groups, $F(1, 10) = 4.60$, $p = .58$, and no significant interaction effect,

$F(3, 30) = 1.89$, $p = .15$. However, there was a significant difference in English elision scores between pre-test and follow-up, $F(3, 30) = 22.21$, $p < .001$, $\eta\rho^2 = 0.69$, indicating improvement with time for both groups. Analyses for blending words did not reveal a significant main effect for type of training, $F(1, 10) = 4.30$, $p = .07$. There was a significant main effect for time of testing, $F(2, 20) = 21.76$, $p < .001$, $\eta\rho^2 = 0.69$, and a significant interaction effect between time of testing and type of training received, $F(2, 20) = 4.47$, $p = .03$, $\eta\rho^2 = 0.31$. Further analysis of the interaction indicated that while the two groups changed over time on English blending words, the gains made from pre-test to follow-up were significant for both the experimental group, $t(4) = -4.70$, $p = .009$, and control group, $t(6) = -19.72$, $p < .001$.

English word reading

The results showed a significant difference in English word reading between pre-test and follow-up, $F(3, 30) = 93.65$, $p < .001$, $\eta\rho^2 = 0.90$, but no significant difference between the two training groups, $F(1, 10) = 1.95$, $p = .19$. Developmental gains in English word reading from pre-test to follow-up were qualified by a significant interaction effect, $F(3, 30) = 3.35$, $p = .03$, $\eta\rho^2 = 0.25$. Further analysis of the interaction showed that children in the experimental group made significantly higher gains than the control group on English word reading at follow-up, $t(10) = 2.29$, $p = .04$, $d = 1.63$, 95 % CI [0.27, 20.02].

French phonological awareness

The analyses did not reveal a significant difference in French elision scores between post-test and follow-up, $F(2, 20) = 3.41$, $p = .053$. There was a significant difference for the two training groups, $F(1, 10) = 14.70$, $p = .003$, $\eta\rho^2 = 0.60$. Furthermore, there was a significant interaction effect in French elision between post-test and follow-up results and the type of training children received, $F(2, 20) = 4.23$, $p = .03$, $\eta\rho^2 = 0.30$. Further analyses revealed that children in the experimental group made significantly higher gains than the control group on French elision at follow-up, $t(10) = 4.48$, $p = .001$, $d = 0.77$, 95 % CI [2.47, 9.32].

There was a significant difference in French blending word scores between post-test and follow-up, $F(1, 10) = 54.75$, $p < .001$, $\eta\rho^2 = 0.85$, but no significant difference between the two groups, $F(1, 10) = 3.61$, $p = .09$. The interaction between the time of testing and the type of training received was significant, $F(1, 10) = 13.05$, $p = .005$, $\eta\rho^2 = 0.57$. The gains made from pre-test to follow-up were significant for both the experimental group, $t(4) = -5.40$, $p = .003$, and control group, $t(6) = -3.12$, $p = .02$.

French word reading

The results revealed a significant difference in French word reading between post-test and follow-up, $F(2, 20) = 60.32$, $p < .001$, $\eta\rho^2 = 0.86$. There was also a

significant difference between the type of training children received, $F(1, 10) = 20.93$, $p = .001$, $\eta\rho^2 = 0.68$. Importantly, a significant interaction effect was found between the time of testing and the type of training received, $F(2, 20) = 4.12$, $p = .03$, $\eta\rho^2 = 0.29$. Further tests indicated that children in the experimental group made greater gains on French word reading at follow-up than children in the control group, $t(10) = 9.57$, $p < .001$, $d = 0.94$, 95 % CI [16.18, 45.03].

Closing the achievement gap for struggling readers

Subsequent analyses were conducted in order to determine whether or not the children in either the experimental or control groups had closed the achievement gap immediately following the intervention at post-test, in comparison to the typically developing readers. Analysis of variance was used to test for overall group differences. To control for heterogeneity of variance and unequal group sizes, follow-up comparisons were evaluated with the Dunnett's C test. The results are displayed in the upper panel of Table 3.

The ANOVA results revealed that subgroups differed significantly in English elision, Welch (2, 10) = 55.66, $p < .001$, French elision, Welch (2, 12) = 61.40, $p < .001$, English word reading, F (2, 219) = 31.42, $p < .001$, and French word reading, F (2, 219) = 19.60, $p < .001$. Follow-up tests showed that, in addition to significant differences between the experimental and control group, the control group had significantly lower scores than the typically developing readers on English elision, $p < .001$, $d = 2.10$, 95 % CI [−11.91, −4.15], French elision, $p < .001$, $d = 1.48$, 95 % CI [−8.22, −4.31], and French word reading, $p < .001$, $d = 2.73$, 95 % CI [−40.77, −20.43]. However, there were no significant differences between the experimental group and the typically developing readers on these measures, suggesting that the experimental group approached a similar level of performance as the typically developing readers on English and French phonological awareness and French word reading at post-test. In English word reading, there was a significant difference between the typically developing readers and both the experimental, $p < .001$, $d = 1.57$, 95 % CI [−25.35, −6.41], and control groups, $p < .001$, $d = 2.76$, 95 % CI [−27.59, −12.57], but no significant difference between the experimental and control groups. Therefore, it can be concluded that neither the experimental nor the control group approached the typically developing readers on English word reading at post-test.

Small-*N* design and qualitative comparisons

Due to the relatively small sample size, we utilized a small-*n* research approach in addition to the statistical comparisons. Figures 1, 2, 3 and 4 illustrate the individual performance of each participant in the experimental and control groups on English elision, English word reading, French elision, and French word reading. Visual inspection of the graphs clearly demonstrates that the students in the experimental group made more gains than the control group over time, particularly on French phonological awareness and French word reading.

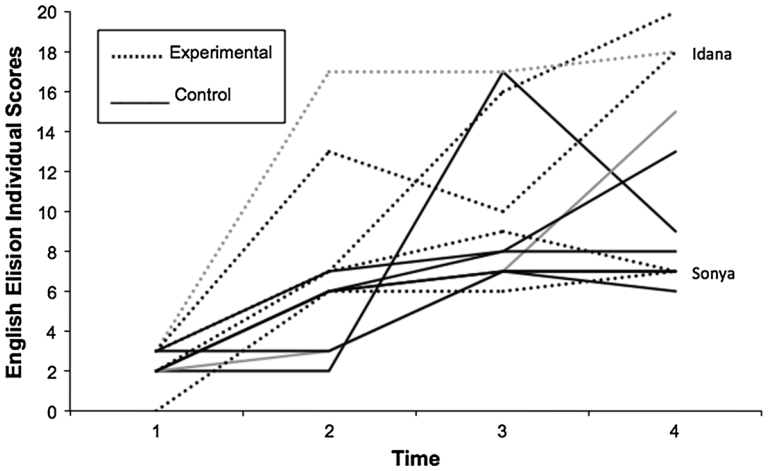

Fig. 1 Participants' individual scores for English elision for the experimental and control groups from pre-test (Time 1) to post-test (Time 4). *Note Grey lines* represent monolingual English-speaking participants

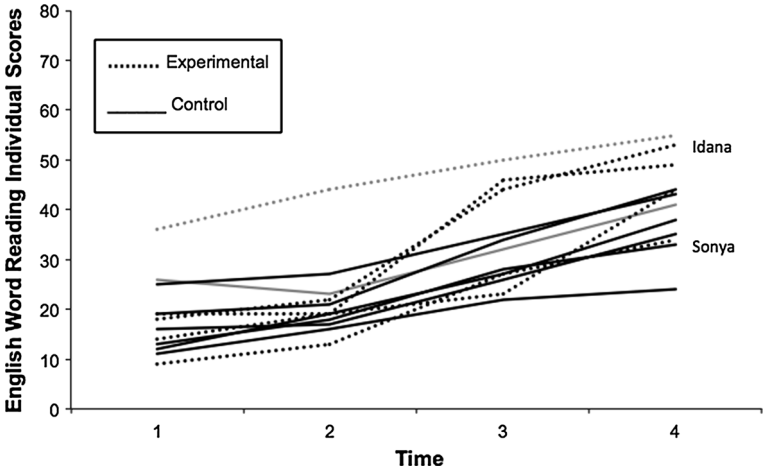

Fig. 2 Participants' individual scores for English word reading for the experimental and control groups from pre-test (Time 1) to follow-up (Time 4). *Note Grey lines* represent monolingual English-speaking participants

The following section presents case studies for two female students who met the selection criteria for inclusion in the intervention group and are representative of the final sample. A close examination of the two students' reading development over time highlights the effectiveness of English phonological awareness instruction in comparison to English vocabulary-building activities in strengthening French and English word reading skills.

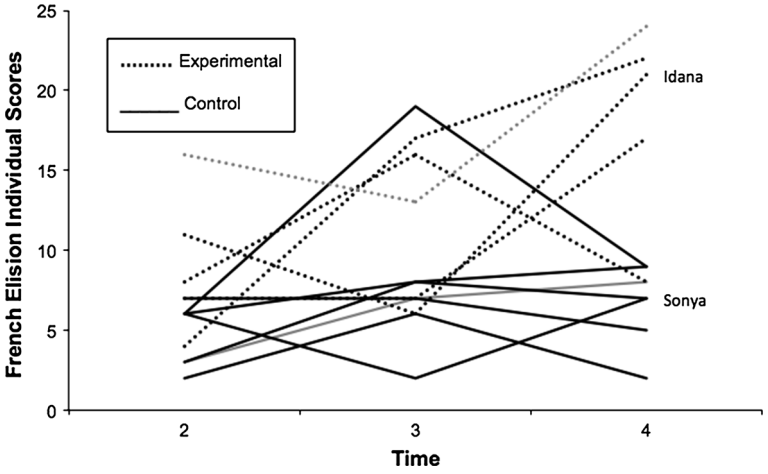

Fig. 3 Participants' individual scores for French elision for the experimental and control groups from post-test (Time 2) to follow-up (Time 4). *Note Grey lines* represent monolingual English-speaking participants

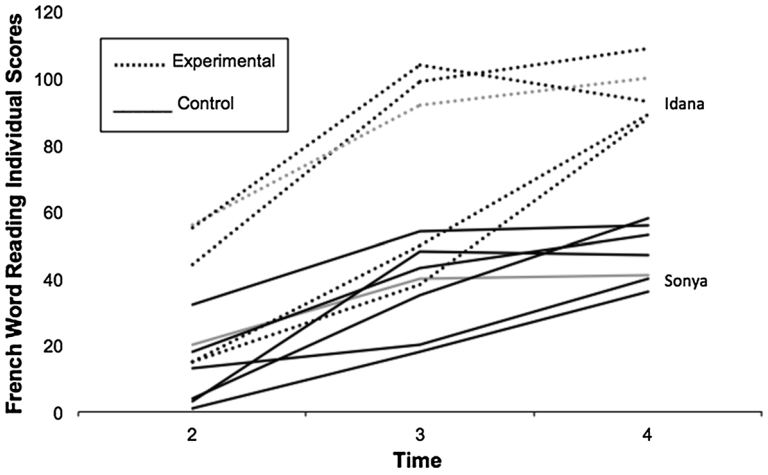

Fig. 4 Participants' individual scores for French word reading for the experimental and control groups from post-test (Time 2) to follow-up (Time 4). *Note Grey lines* represent monolingual English-speaking participants

Case study 1: "Sonya"

When Sonya entered French immersion in grade 1, she was 6 years 6 months of age. She had been born in Canada, and Russian was her first language. She had acquired conversational proficiency in English, and was learning French as an additional language. In the first few months of grade 1, Sonya had difficulty remaining focused on assigned tasks and demonstrated a preference for socializing with her peers.

Following the administration of pre-test measures, Sonya was assigned to the control group. Her scores on English elision and English word reading at pre-test were 2 and 13 respectively; both were much lower than the mean scores of the typically developing readers. Although Sonya made modest gains on tests of English elision from pre-test to post-test (score = 6), she made almost no gains from post-test to delayed post-test (score = 7), and delayed post-test to follow-up (score = 7) (Fig. 1). Sonya made some gains in English word reading from pre-test to follow-up (score = 33), but even at follow-up, her performance on measures of English word reading was much lower than that of typically developing children two years earlier (Fig. 2). In French, Sonya's elision scores showed a decline from post-test (score = 6) to delayed post-test (score = 2), and subsequently recovered to their previous levels at follow-up (score = 7) (Fig. 3). The gains she made in French word reading from post-test (score = 13) to follow-up (score = 40) were negligible in comparison to her typically developing peers (Fig. 4). In grades 1 through 3, Sonya's classroom teachers rated her French reading skills as below average.

Case study 2: "Idana"

Idana was 6 years 8 months of age upon entry into the grade 1 French immersion program. She had also been born in Canada, and spoke Russian as a first language. Similar to Sonya, she had attained conversational proficiency in English, and was acquiring French as an additional language. During the first term of the academic year, informal observations suggested that although Idana was attentive during classroom instruction, she had frequent conflicts with peers and needed adult assistance in order to resolve them. After pre-test measures were administered, Idana was assigned to the experimental group. Her performance on English elision (score = 3) and English word reading (score = 18) at pre-test was also very low and comparable to Sonya's performance. Idana's gains on tests of English elision from pre-test to post-test (score = 13) were sizable (Fig. 1). Her performance decreased at delayed post-test (score = 10), but improved again at follow-up (score = 18). Despite the fact that her gains in English word reading from pre-test to post-test (score = 22) were modest, her gains from post-test to delayed post-test (score = 44), and delayed post-test to follow-up (score = 53) were substantial (Fig. 2). In French, although Idana's elision score showed a decline from post-test (score = 11) to delayed post-test (score = 6), she made notable gains from delayed post-test to follow-up (score = 21) (Fig. 3). Idana made considerable gains in French word reading from post-test (score = 55) to delayed post-test (score = 104), but her scores showed moderate decline from delayed post-test to follow-up (score = 93) (Fig. 4). In grades 1 and 2, Idana's teachers rated her French reading skills as low average and average respectively, and in grade 3, her skills were rated as high average.

Summary

Idana's substantial gains on measures of English elision from pre-test to post-test support results of previous studies examining the immediate effects of phonological awareness training in combination with letter-sound correspondence instruction (National Reading Panel, 2000). In comparison, Sonya made only modest gains in English elision during this same period of time. It is possible that the English phonological awareness instruction Idana received accounted for her sizable gains in English word reading from post-test to delayed post-test and delayed post-test to follow-up, as she received no English literacy instruction in the classroom during the primary grades. In contrast, Sonya demonstrated only small gains from pre-test to follow-up on measures of English word reading.

Idana's French elision results from delayed post-test to follow-up suggest that once phonological awareness was established in English immediately following the intervention phase of the study, she was able to transfer her newly acquired phonological awareness to French. Sonya's French elision performance showed no such improvement during this same period of time. Idana's substantial gains in French word reading from post-test to delayed post-test suggest that her French reading skills were facilitated by her acquisition of French phonological awareness. Although Sonya made steady gains in French word reading from post-test to follow-up, these gains were only modest.

Discussion

The current intervention study investigated the effectiveness of a supplemental phonological awareness intervention for struggling readers from diverse linguistic backgrounds in an early French immersion program. Across three consecutive years and cohorts, English measures of phonological awareness and word reading were administered in order to identify grade 1 children who were having difficulty acquiring reading skills. In small groups for 18 weeks, children in the experimental group were provided with English phonological awareness training in combination with letter-sound correspondence instruction. Those in the control group were involved in English vocabulary-building activities. Post-testing was completed during grade 1 immediately following the intervention, and again during grades 2 and 3. Results support previous intervention research examining the immediate effects of combination phonological awareness training and letter-sound correspondence instruction. Specifically, children in our sample who received the phonological awareness intervention demonstrated significantly higher gains than the control group on English phonological awareness measures from pre-test in the fall of grade 1 to post-test, immediately following the intervention. Furthermore, results revealed that there were no significant differences in English elision between the experimental group and typically developing readers at post-test; however, there were significant differences between the experimental and control groups. In other

words, the children in the experimental group had begun to close the achievement gap immediately following the intervention phase of the study.

Our findings extend those of previous research by investigating the delayed effects of English phonological awareness training on English and French phonological awareness and word reading in French immersion at-risk readers. Results indicated that while training gains made in English phonological awareness for the experimental group were reduced and no longer significant at follow-up in grade 3, group differences in French phonological awareness peaked and reached statistical significance. In the same way, and consistent with our hypothesis, the experimental group made greater gains than the control group on French word reading from post-test at the end of grade 1 to follow-up at the end of grade 3. These findings attest to the cross-language transfer of phonological awareness (Durgunoğlu et al., 1993; Cisero & Royer, 1995; Comeau et al., 1999) and demonstrate that explicit and systematic phonological awareness training in English can significantly improve French phonological awareness and word reading over time.

Our early intervention study is the first to demonstrate that English phonological awareness training in combination with letter-sound correspondence instruction can effectively facilitate French reading acquisition for early immersion students who are struggling to learn to read. Although a previous French immersion investigation (MacCoubrey, 2003) attempted to establish a link between a phonologically based reading intervention and reading development, no such link was successfully established. Perhaps this disparity can be explained by the fact that the provision of daily reading instruction is not a curriculum expectation for kindergarten students. Thus, grade 1 may be a better time to provide supplemental phonological awareness training for struggling readers in an early French immersion program as it supports the daily classroom practices of teachers and thereby produces sustained positive effects on reading performance (Snow et al., 1998).

A particularly striking finding in this investigation was that the group differences in English word reading reached statistical significance at follow-up. In other words, although the experimental and control groups appeared to grow at the same rate in English word reading from pre- to post-test, the children who received the phonological awareness intervention in combination with letter-sound correspondence instruction made significantly higher gains from pre-test to follow-up in comparison to those in the control group. Our study is the first to demonstrate the sustained effects of English phonological awareness training on the acquisition of English reading skills, and suggests that it may be possible for children who receive phonologically based interventions to become proficient readers in both French and English. Due to our small sample size, the effect of English phonological awareness training on English word reading for French immersion children needs to be further examined.

The results of the present investigation contribute novel evidence to the literature regarding reading development in the early French immersion context. As we have seen, early intervention opportunities have only been available to struggling readers in English-mainstream programs in past years. Children who experienced difficulty with reading acquisition were often counselled out of French immersion in order to access instructional interventions generally provided in the English stream (e.g.,

Genesee & Jared, 2008; MacCoubrey et al., 2004). Our study demonstrates that struggling readers who are enrolled in early immersion programs and have been provided with English phonological awareness training might be able to improve their French reading skills without having to withdraw from French immersion. By remaining in immersion, these children could benefit from the many advantages associated with becoming functionally bilingual.

A primary strength of our investigation lies in the early identification and intervention of children who are struggling with reading acquisition in the beginning of their educational careers. The identification of at-risk readers is typically delayed in French immersion programs until grades 2 or 3, due to the prioritization of oral language proficiency in early immersion classrooms. As a result, weak readers often fail to get the timely support they need and experience a distinct disadvantage to their peers in reading after switching to the English stream (e.g., Parkin et al., 1987). By assessing reading risk using English measures, we were able to identify at-risk readers at the beginning of the school year and provide them with effective supplemental interventions to improve their reading skills.

Another strength of our study is that our early intervention program could be easily replicated in any immersion elementary school. Using English measures of phonological awareness and word reading, it would be possible for kindergarten or grade 1 teachers to identify students who are showing early signs of difficulty with reading acquisition immediately upon entry into immersion. They could then offer phonological awareness training before the achievement gap becomes too wide to bridge. For struggling readers, classroom-based phonological awareness instruction in the large group setting is insufficient to meet their learning challenges and needs to be reinforced with systematic and explicit phonological awareness training provided in combination with letter-sound correspondence instruction on a withdrawal basis (National Reading Panel, 2000). Intensive, small group instruction would support the daily classroom practices of teachers so that the positive effects of phonological awareness training would be sustained over time.

Finally, it is worth noting that our intervention cohort design included four time points to measure the sustainability of the treatment effects. A rigorous methodology was employed in this investigation, which included an index of treatment fidelity that was utilized to ensure that the two training conditions were faithfully implemented. Although using a sole instructor who was not blind to the conditions may have limited generalizability of the results, it could be argued that 94 % accurate implementation indicates that our efforts to minimize instructional drift were highly successful.

The present study also has several limitations. First, the number of struggling readers that we identified was small, which limits our ability to detect significant results and generalize our results. Although gains in phonological awareness were evident on English and French phonological awareness and word reading measures for children from both English-speaking and diverse linguistic backgrounds, future investigations should explore whether or not any significant differences in performance between these two groups can be found. Second, groups of students from intact classes, rather than individual students, were randomly assigned to experimental and control conditions. If possible, future studies should adopt a

complete random assignment to rule out the confounding effect of class. Third, by having an instructor for both conditions in all 3 years of the investigation, we may have suitably addressed instructor-by-condition confounds but limited generalizability of the results. Lastly, we relied heavily upon experimental French outcome measures in this study, due to the lack of availability of standardized measures of phonological awareness and reading. In view of these limitations, our research needs to be replicated by future investigations with more rigorous methodologies.

Navigating the complexities of conducting educational research in a French immersion elementary school is certainly challenging, particularly when it involves the provision of supplemental reading instruction on a withdrawal basis. On several occasions, the teachers expressed concern about the hours of essential classroom instruction their students were prevented from receiving as a result of their participation in the study. A second challenge faced by the research team was attrition. As we have seen, children who are struggling with reading acquisition in French immersion elementary schools are often encouraged to switch to an English stream program. The regularity with which this happens had a direct and profound effect on this research project. Specifically, four of the 16 struggling readers withdrew from the French immersion program and were unavailable for delayed post-testing and/or follow-up. A third issue was the ability to deliver small group instruction to struggling readers on a consistent basis. A number of factors such as school-wide events (e.g., assemblies) and individual health issues (e.g., general absenteeism due to illness) adversely affected the regularity with which supplemental reading instruction could be delivered.

In sum, the present investigation succeeds in demonstrating that children enrolled in French immersion programs who are showing early signs of difficulty acquiring reading skills can be identified immediately upon entry into the program and provided with phonologically based reading interventions at an early stage in their literacy development. Our results suggest that it is not necessary for immersion teachers to wait for students to become orally proficient in the target language before undertaking assessment of reading risk. Once identified, intensive, evidence-based, small group reading interventions can be provided in early French immersion programs for children who are struggling to learn to read. It is now conceivable that young readers who are experiencing learning challenges in bilingual education programs, such as French immersion, have the opportunity to become proficient bilingual readers.

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