The role of morphology in spelling: Long-term effects of training

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Abstract

We compared the effectiveness of two spelling interventions: one focused on morphological structure and one emphasizing word meanings,, on spelling acquisition in French speaking children in 3rd and 5th grades. The morphology intervention led to significantly greater improvement in spelling than the vocabulary intervention, especially for children in grade 5. To compare the long-term effects of the two interventions, we tested the children's spelling ability six-months after the conclusion of the intervention program. Results show that both grades maintain an increase in spelling accuracy compared to their pre-intervention performance. Additionally, the children in grade 5 who received morphological instruction retained more spelling knowledge than those who received the vocabulary instruction. These results suggest that teaching children about the structure of complex words supports their spelling ability in the long-term, providing evidence for the importance of morphological knowledge in literacy development.

Keywords: morphology; spelling; literacy development; vocabulary; intervention; French

Introduction

Learning to spell is a critical aspect of literacy development, yet research has typically focused on the development of reading skills. Understanding the process of learning to spell has become particularly important in Quebec, where a widespread decline in children's spelling ability has become apparent (Jalbert, 2007). Contributing to this decline is the difficult nature of French spelling. French has a one-to-many mapping of sounds-to-orthography, so the same sound may be written in a number of different ways. Additionally, silent letters are common in written French, so children must learn to spell parts of words for which there is no overt pronunciation to guide them. These features of written French make learning to spell in this language a complex task.

Recent evidence suggests that literacy instruction focused on morphological knowledge, or on the ability to recognize and process sub-lexical units in language (e.g., recognizing that the word *reheatable* is made up of three sub-parts, the prefix *re-*, the stem *heat*, and the suffix *-able*) may assist children's spelling development. In fact, children who have greater metalinguistic awareness of morphological structure are better able to spell words correctly (e.g., Deacon, Kirby, & Casselman-Bell, 2009; Sénéchal, 2000) and teaching children explicitly about the morphological relationships between words improves their reading and writing skills (see Bowers, Kirby, & Deacon, 2010, for a review).

While morphological awareness training may be a beneficial teaching method for fostering literacy development, there are a number of important issues to be resolved to ensure that children receive the most effective instruction. Firstly, most of this evidence is derived from studies of English-speaking children, and little is known about the contribution of morphological skills to writing ability in French (cf. Sénéchal, 2000; Sénéchal, Basque, & Leclaire, 2006; Pacton & Deacon, 2008). French has a richer morphological system than English, so it is likely that morphology may have an even more influential role in learning to spell in French. Intervention studies with French-speaking children are needed to test this hypothesis.

Additionally, children as young as two to three years demonstrate knowledge of morphology (Berko, 1958; Clark, 1993, Gonnerman, 2007), but it is not clear when this knowledge begins to influence spelling ability. Some researchers have argued that morphological knowledge has an early influence as children begin to develop literacy skills (e.g., Deacon & Kirby, 2004), while others report that the influence of morphological knowledge on spelling ability does not have a large impact until later in development (e.g., Carlisle, 1995; Kirby et al., 2012; Singson, Mahony, & Mann, 2000). To provide the most effective instruction to children, it is crucial to understand the most appropriate stage of development to introduce morphological training.

Typically, instruction of morphological structure also involves discussion of word meaning, because morphologically related words share similar form and meaning. Previous studies have yet to investigate the distinction between morphological and vocabulary instruction (e.g., St-Pierre & Dubé. 2012), thus the relative contribution of morphology versus semantics to improving spelling ability is unknown. To disambiguate the potential benefit of morphological knowledge from the benefits of word meaning instruction, it is necessary to isolate the teaching of morphological structure and compare its effects on spelling outcomes to that of vocabulary training.

Finally, it is important to find out whether the benefits of a morphological intervention program can be maintained across time, and whether the knowledge will transfer to new words not taught in the intervention. Carlisle (2010) conducted a review of instructional programs using morphological awareness training to improve literacy outcomes, and reported that the majority of these studies fail

to report the long-term maintenance of the effects, or the transfer of learning to new words. It is critical to evaluate both the maintenance and transfer of learning to ensure that a morphological intervention provides children with long-lasting abilities beyond the context of the intervention.

We have conducted an intervention study to investigate the role of morphological training for improving spelling in Quebec French. In a previous study, we analyzed and reported the results immediately after the conclusion of the intervention. The focus of the present study is to examine the long-term effects of the intervention, as measured at a follow-up session six months after the conclusion of the intervention. We compared the long-term effects of morphological instruction for 3rd graders and 5th graders, explicitly contrasting its relative contribution to spelling ability with that of vocabulary instruction. Thus, our research question is two-fold:

1. Is there a difference in relative long-term intervention effectiveness by grade? That is, will a morphology intervention improve long-term spelling performance of children in grade 3 versus 5?

2. Is there a difference in long-term intervention effectiveness by instruction method? That is, will a morphology intervention lead to great long-term spelling improvement than a vocabulary intervention?

In the sections that follow, we describe the intervention that was conducted, as well as the spelling outcomes following the intervention for children in grades 3 and 5 To address our research questions, we present data from a six-month follow-up test evaluating the long-term effectiveness of the morphology and vocabulary training for improving spelling performance.

Overall, we expect that the children will experience some degree of forgetting, such that their spelling accuracy at the six-month follow-up will be lower than at post-intervention; however we expect that the children will retain some of the spelling knowledge from the intervention, so their spelling scores at the six-month follow-up will be higher than at the pre-intervention. Moreover, we predict that the greater benefit observed for the morphology intervention will be maintained in the long-term.

The Present Study

We developed an intervention to target the spelling of a set of morphologically complex words, with emphasis on either morphology or vocabulary instruction. The present study aims to assess the long-term outcomes of our spelling intervention. Six months after the intervention ended, we went back to the school and administered the same spelling test to the children who had participated in the intervention. The children's performance on this test at the six-month follow-up will be compared to their performance on the test as measured before the intervention as well as immediately after the intervention.

Methods

Participants

Eighty-four children were recruited from one elementary school in the greater Montreal area and took part in the intervention. Children from two Grade 3 and two Grade 5 classes within the school participated. The primary language of instruction in this school is French. 36 children from Grade 3 participated (23 girls and 13 boys), as well as 48 children from Grade 5 (27 girls and 21 boys).

Children were randomly assigned to one of the two treatment groups, based on their general spelling abilities prior to their participation in the intervention study. General spelling ability was assessed using a modified version of the Test Ortho3 from the Batterie d'Évaluation du Langage Écrit et de ses troubles (BELEC) (Mousty, Leybaert, Alegria, Content, & Morais, 1994). Children in each intervention group were also matched on language background (monolingual Francophone, or multilingual), and gender, with approximately equal ratios of boys to girls in each treatment group.

The intervention

Children in grade 3 and grade 5 took part in the intervention. The children were divided into two groups, one which received instruction explicitly focused on the morphological structure of the words to be learned (Morphology group), the other receiving instruction focused on the meanings of the words (Vocabulary group). For example, the Morphology group was taught that there are two parts to the word *finlandais*, namely the stem *finland* and the suffix -*ais*, while the Vocabulary group was taught that the word *finlandais* describes something or someone that comes from the country, Finland. The children were taught to spell an identical set of 30 words, with only the emphasis of instruction differing across intervention groups. The intervention was given during 10 weekly sessions, each lasting one hour.

Ten suffixes were taught in the intervention. The suffixes were relatively frequent and productive in Quebec French, such that they are preferentially used to form new words. Three words were chosen containing each of the 10 suffixes, creating the list of 30 words that were taught in the intervention. These words were relatively infrequent, so it would be unlikely that the children in grade 3 or 5 would already know these words.

The 30 words were distributed across the 10 intervention sessions, with three words taught per session. In each session, the children in the Morphology group were taught the three words with the same suffix. For the Vocabulary group, words with the same suffix were distributed across the 10 sessions, such that the words with the same suffix were never taught in the same session. For example, in the first session, the Morphology group was taught *finlandais*,

japonais, and *camerounais*, whereas the Vocabulary group was taught *ogresse*, *huileux*, and *galanterie*. Thus, each group was taught the same words, just in different sessions.

Materials for assessing intervention effectiveness

We developed a test to determine the effectiveness of the intervention on children's spelling ability. This test was administered before (*pre-intervention*), immediately after (*post-intervention*), and six months after the intervention concluded (*six-month follow-up*). We designed this spelling test to measure specific outcomes from our intervention. The test assessed the spelling of complex and simple words, and required children to generalize stems and suffixes taught in the intervention to new words not taught in the intervention. The items on the test were either the exact complex word taught in the intervention (i.e., a taught stem and a taught suffix), a taught or an untaught stem without a suffix, or a combination of a taught/untaught stem and suffix in a complex word (i.e., a taught stem with a new suffix, or a new stem with a taught suffix).

Procedure

All students took the spelling test in the classroom at the same time. The instructor read each sentence once, repeating the missing words as many times as necessary for all students to fill in the missing word. The instructor was a female native speaker of Quebec French.

Results and Discussion

We assessed the effects of our intervention immediately following the conclusion of the intervention program, analyzing the changes in spelling performance from pre- to post-intervention. Before we report the results of the six-month follow up, the pre- to post- test analyses will be summarized. As the focus of the present study is the long-term spelling outcomes, only statistics including the six-month follow-up scores will be reported in this paper.

There were 15 children who participated in the original intervention who were absent from the six-month follow-up session. These children were excluded from the following analyses. Additionally, 3 children were absent from either the pre- or post-intervention assessment, and these children were also excluded from the following analyses.

The children's performance on the spelling test was scored based on whether the whole words were spelled correctly, and also whether the stems and suffixes of complex words were spelled correctly. Accordingly, each complex word received three scores, one for the whole word, one for the stem, and one for the suffix. Mean percent correct scores on the whole words, stems, and suffixes were calculated for the following analyses.

Question #1: Is there a difference in relative long-term intervention effectiveness by grade?

Pre- to post- intervention summary We compared the changes in spelling accuracy over all the items on the spelling test, from pre- to post-intervention, for grade 3 and 5 students. The results of this analysis revealed that children in both grades improved their spelling from pre- to post-intervention, with children in grade 5 scoring higher overall than those in grade 3. However, the children in grade 3 showed a greater differential between pre- and post-intervention than those in grade 5, indicating that the children in grade 3 were aided more by the intervention, irrespective of the type of instruction.

To test whether these differences remained six months after the intervention, we calculated mean percent correct at each test time. These mean scores for grades 3 and 5 are displayed in Figure 1. We entered the whole word accuracy scores on all of the spelling test items into a 2x3 ANOVA with the factors Grade (grade 3 or grade 5) and Test Time (pre-intervention, post-intervention, or six month post) to assess the long-term effects of the intervention for each grade. The main effect of Grade was significant, $F(1, 64) = 16.98$ $p < .001$, indicating that the children in grade 5 scored significantly higher than the children in grade 3. The main effect of Test Time was also significant, $F(2,128) = 174.92$, $p < .001$, as was the interaction of Grade and Test Time, $F(2,128) = 6.73$, $p = .002$, indicating significant differences between the spelling performance of grade 3 and 5 children across the three testing sessions.

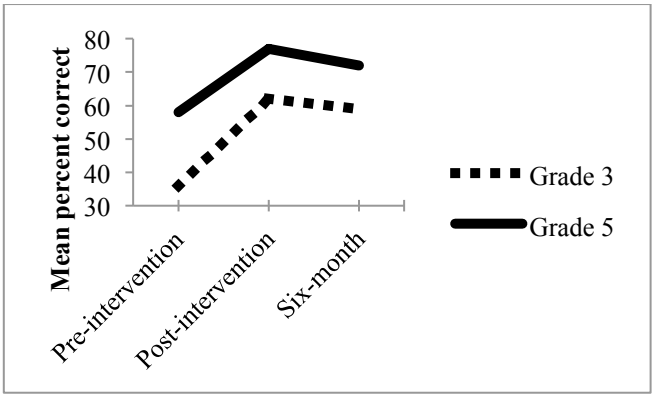

Figure 1: Overall mean percent correct on the spelling test, for grade 3 and grade 5 at pre-intervention, post-intervention and the six-month follow-up.

Post-intervention to six-month follow-up To specifically examine the potential differences in the long-term effects of the intervention for grade 3 and 5 children, a planned comparison of the whole word accuracy scores for all items, with the factors Grade (grade 3 or grade 5) and Test Time (post-intervention or six month post) was conducted. The results show that the grade 5 children had significantly higher spelling scores than the grade 3 students from post- to six month post-intervention, $F(1,64) = 11.55$, $p < .001$. Collapsing across both grades, scores were significantly higher at post-intervention than at the six month follow-up, $F(1,64) = 12.01$, $p < .001$, indicating that the children had forgotten some of the spelling knowledge they gained from the intervention six months later. Interestingly, the

interaction of Grade and Test Time was not significant, $F(1, 64) = .35$, $p = .55$, indicating no difference between grade 3 and grade 5 in the amount of spelling knowledge that was forgotten. In fact, there was only a small, albeit significant, decrease in spelling ability six months after the intervention, approximately 5% in each grade.

Pre-intervention to six-month follow up To ensure that six months later the children retained much of the spelling knowledge they originally gained from the intervention, we conducted a planned comparison of the whole word spelling accuracy scores of all items, with the factors Grade (grade 3 or grade 5) and Test Time (pre-intervention or six month post-intervention). Once again there was a significant main effect of Grade, $F(1,64) = 17.57$, $p < .001$, such that the children in Grade 5 scored higher than those in Grade 3. The main effect of Test Time was significant, $F(1,64) = 193.01$, as was the interaction between Grade and Test Time, $F(1,64) = 10.85$, $p = .002$. These results indicate that children in both grades maintained their spelling improvement, scoring higher at the six-month follow-up than at pre-intervention. Moreover, the children in grade 3 improved more from pre-intervention to the six-month follow-up than the children in grade 5. Thus, the children display long-term learning, having retained a large amount of the spelling knowledge that they gained from the intervention six months later.

Question #2: Is there a difference in long-term intervention effectiveness by instruction method?

Pre- to post- intervention summary Given the differences between grades in intervention effectiveness, we analyzed pre- to post- intervention differences between the Morphology and Vocabulary group for each grade separately. In general, children in both instructional groups increased from pre- to post- intervention, indicating that both types of instruction effectively improved children's spelling ability for both 3rd and 5th graders. Looking more closely at the accuracy for stems and suffixes of the test items, differential effects according to intervention group emerged, with the Morphology group showing a larger increase in spelling accuracy than the Vocabulary group.

The results immediately following the intervention suggest that the instruction focusing on the morphological structure of words provides an advantage to children over an intervention that focuses on word meanings. Specifically, children who have had morphological-based training were able to generalize the knowledge they gained in the intervention to be able to correctly spell morphologically related words that had not been taught directly. While the Morphology group showed differential improvements over the Vocabulary group in both grades, the morphological intervention provided the strongest benefit for children in grade 5.

To determine whether the advantage of a morphological intervention over a vocabulary intervention for learning to spell was maintained after a period of no instruction, we compared the changes in spelling accuracy of the two intervention groups from immediately after the intervention to the six-month follow-up assessment. Additionally, we compared the long-term effects of the morphology and vocabulary instruction for 3rd and 5th grade separately, to determine the developmental stage for which the spelling intervention is most effective. Each grade was thus examined separately in the following analyses.. The mean percent correct on the complex words, stems and suffixes for both intervention groups are displayed in Table 1 for Grade 5, and in Table 2 for Grade 3.

Table 1. Grade 5 mean percent correct on complex words, stems and suffixes at post-intervention and six-month follow-up.

	Morphology Group					Vocabulary Group				
	Post-intervention		Six-month follow-up		Mean Difference	Post-intervention		Six-month follow-up		Mean Difference
	M	*SD*	*M*	*SD*		*M*	*SD*	*M*	*SD*	
Complex Words	83.33	17.25	74.31	17.40	-9.02	86.84	15.29	68.42	21.40	-18.42
Stems	86.96	9.66	78.99	13.52	-7.97	80.78	15.76	75.06	16.00	-5.72
Suffixes	91.67	7.11	88.19	8.27	-3.48	93.42	6.41	83.55	13.54	-9.87

Table 2. Grade 3 mean percent correct on complex words, stems and suffixes at post-intervention and six-month follow-up.

	Morphology Group					Vocabulary Group				
	Post-intervention		Six-month follow-up		Mean Difference	Post-intervention		Six-month follow-up		Mean Difference
	M	*SD*	*M*	*SD*		*M*	*SD*	*M*	*SD*	
Complex Words	81.25	16.08	63.39	21.63	-17.86	78.33	21.89	65.00	16.50	-13.33
Stems	72.98	15.27	67.70	13.82	-5.28	73.91	18.00	68.12	19.28	-5.79
Suffixes	88.39	7.70	81.70	13.97	-6.69	79.58	19.11	76.67	16.61	-2.91

Performance on complex words We first looked at the long-term changes in whole word spelling accuracy of the complex words that were taught in the intervention. The whole word scores for the complex taught words were entered into a separate ANOVA for each grade, with the factors Intervention Group (morphology or vocabulary) and Test Time (post-intervention or six-month post-intervention). Looking first at the results for grade 5, the main effect of Test Time was significant, with children scoring higher at the post-test session, than the pretest session, $F(1,35) = 21.98$, $p < .001$. The main effect of Group was not significant, $F(1,35) = .05$, $p = .81$, nor was the interaction of Test Time and Group,, $F(1,35) = 2.52$, $p = .12$. Thus, both groups display some forgetting of how to spell the complex words that were taught in the intervention, but this change is not differential based on the intervention group.

For the 3rd graders, the main effect of Test Time was once again significant, $F(1,27) = 20.68$, $p < .001$, while the main effect of Group was not significant $F(1,27) =$, $p = .92$. Unlike the pattern observed in the 5th grade, the interaction of Group and Test Time was not significant, $F(1,27) = .44$, $p = .51$. For children in grade 3, after six months both groups showed a similar decrease in spelling accuracy for the complex words taught in the intervention.

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Performance on stems To assess the long-term effects of instruction on the spelling of taught stems, mean percent correct scores for taught stems were entered into an ANOVA with the factors Test Time (post-intervention or six-month-post intervention) and Group (morphology or vocabulary), for each grade separately. The results for the 5th grade children showed a significant main effect of Test Time, $F(1,35) = 12.70$, $p = .001$, but not a significant main effect of Group, $F(1.35) = 1.44$, $p = .24$, nor an interaction between Test Time and Group $F(1,35) = .35$, $p = .56$.

Similarly, in the 3rd grade, the main effect of Test Time was significant, $F(1,27) = 9.68$, $p = .004$, while the main effect of Group and the interaction of Test Time and Group were not, $F(1,27) = .01$, $p = .91$, $F(1,27) = .02$, $p = .89$, respectively. For both Grade 3 and Grade 5, performance on the taught stems decreased somewhat for both the morphology and vocabulary groups, but this small decrease was the same across both groups. Thus, the initial learning based on the intervention resulted in approximately 21-31 percent increases in spelling of the stems, and after 6 months, both groups still showed significant improvements in spelling, only dropping 1 to 6 percent in their scores.

Performance on suffixes We compared the long-term effects of the two intervention types on the spelling of suffixes taught in the intervention. For each grade, the mean percent correct scores for taught suffixes were entered into separate ANOVAs, with the factors Test Time (post-intervention or six-month post-intervention) and Group (morphology or vocabulary). For grade 5, the main effect of Test Time was significant, $F(1,35) = 18.22$, $p < .001$, while the main effect of Group was not, $F(1,35) = .30$,$p = .56$. Interestingly, the interaction of Group and Test Time was significant $F(1,35) = 4.08$, $p = .05$, revealing that six months after the intervention, the morphology group showed greater retention for the spelling of taught suffixes. This finding suggests that for children in grade 5, instruction focused on morphological structure is more beneficial in the long-term for learning to spell morphologically complex words than instruction focused on word meaning.

The analysis for grade 3 children showed that the main effect of Test Time was marginally significant, $F(1,27) = 4.00$, $p = .06$, and that the main effect of Group was not, $F(1,27) = 1.86$, $p = .18$. In contrast to Grade 5, the interaction of Test Time and Grade was not significant for Grade 3, $F(1,27) = .64$, $p = .43$. There is a slight decrease in the spelling of taught stems at the six-month follow-up for both intervention groups, and this decrease is not different by intervention received. Given the differing pattern of results for performance in the spelling of taught suffixes, with the 5th graders in the morphology group showing greater retention, the morphology-based instruction seems to provide an advantage over a vocabulary-based instruction for learning to spell at later stages of literacy development.

General Discussion

The present study evaluated the long-term effectiveness of a morphology-based intervention for elementary school-aged French-speaking children. The intervention contrasted the effects of a training program focused on the morphological structure of words, with one that concentrated only on word meaning. While other intervention studies have confounded morphology and vocabulary instruction (see Bowers, Kirby, & Deacon, 2010, for a review), our study design allowed us to disambiguate the relative benefits of morphology and vocabulary instruction for spelling outcomes. Additionally, by conducting the intervention with children in 3rd and 5th grade, we could assess the effects of morphological instruction at different stages of literacy development.

While both interventions led to significant spelling improvements from pre- to post-intervention, the Morphology group displayed significantly greater improvement in their ability to generalize their spelling knowledge beyond the words that were taught in the intervention. The differential benefit in favour of the morphology group was particularly pronounced for the children in grade 5. Overall, the results suggest that teaching children about morphological structure successfully improves spelling accuracy more than instruction based on word meaning does.

In addition, in the results reported here, we demonstrate the long term learning effects of the morphology intervention by re-examining the children after a six-month delay. We found that for both the morphology and vocabulary groups, the improvement in spelling accuracy remains six months later, as the children spell significantly better at the six-month follow-up than at pre-test. These effects hold for children in both grades 3 and 5. The

children do display some forgetting at the six-month mark, with scores significantly decreasing from post-intervention to six-month follow-up, however, the decreases were very small (approximately one to six percent) and there were no differences in the amount of forgetting between grades. This finding suggests that, regardless of instruction type, children benefit from our spelling intervention.

Importantly, when examining the differential effects of instruction type, we found a significant, long-term advantage for grade 5 children in the Morphology group over children in the Vocabulary group. At the six-month follow-up, those who received morphology instruction showed greater retention of spelling knowledge than those who received the vocabulary instruction. Our intervention study and the subsequent follow-up suggest that morphological training provides sustained improvement to children's spelling accuracy in French, greater than instruction on word meaning, particularly for older elementary school-aged children.

Conclusion

Findings from our follow-up study provide support for an advantageous role of morphology instruction for spelling outcomes in Quebec French. Explicitly teaching children about the components of complex words helps them to spell stems and suffixes better, and to generalize their knowledge beyond the words taught in the intervention. For older children, these effects are maintained well after instruction is finished, indicating that morphology instruction would be a useful tool for dealing with the spelling difficulties observed in Quebec. While we did not see the same differential long-term benefit of morphology training in the younger children, our findings indicate that both types of intervention were very beneficial in the long-term. As such, an intervention combing instruction of morphological structure and vocabulary knowledge may be especially helpful for these children.

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