

Rapport
de recherche
PROGRAMME ACTIONS CONCERTÉES

**Exploiter les connaissances des enfants sur les relations entre
les mots afin d'améliorer l'orthographe au Québec francophone:
Étude expérimentale et d'intervention**

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PARTIE A – CONTEXTE DE LA RECHERCHE

In today's literate society, being able to read and to write is crucial for success, both personally and professionally. A critical aspect of gaining command of the written language is the ability to spell words correctly. In fact, spelling ability represents a sensitive measure of children's overall skills in literacy, as it is one of the first areas to manifest difficulty in children at risk for developing reading and writing problems. In addition, we view spelling as a window into children's developing language system and mental lexicon, as it represents a gamut of global skills, drawing upon meaning, syntax, and broader language skills. Studies of literacy development typically focus only on reading skills; however, a recent concentration on the development of spelling skills has emerged (cf. Griva & Anastasiou, 2009). The importance of understanding how children learn to spell has become particularly apparent in Quebec, where children's written French has gained attention for widespread problems with spelling (Jalbert, 2007).

Literacy research typically focuses on identifying the cognitive processes that underlie reading and spelling ability, and the ways in which these processes can be incorporated into instruction. Although research has focused on the impact of phonological processing for developing literacy ability, there are other cognitive skills that play an important role. For instance, certain languages like English and French also represent morphemes, or units of meaning, in the written form. As such, the development of literacy skill in these languages also involves learning how morphemes, map onto the written form. In fact, evidence suggests that morphological knowledge is a critical skill for improving the spelling ability of children. For example, the pronunciation 'ea' sound in *reaching* and *react* differs depending on where the morphemes are in the word. Given that 60-80% of new

words that school-aged children must acquire are morphologically complex (Nagy, & Anderson, 1984), it is reasonable to expect that knowledge of morphological structure is important for accurate spelling. A growing body of research suggests that children who have greater morphological awareness are better able to spell words correctly (Deacon, Kirby, & Casselman-Bell, 2009; Sénéchal, 2000). In addition, teaching children explicitly about the morphological relationships between words has been shown to improve their reading and writing skills in English (see Bowers, Kirby, & Deacon, 2010, for a review).

French has richer morphology than English, so the role of morphology in spelling is likely to be even more important for children learning French. For example, silent letters are common in written French, so children must learn to spell parts of words for which there is no overt pronunciation to use as a guide, for example *candidat* ends in a *t* which is silent. Children may be more successful at spelling these silent letters if they are aware of morphologically related, complex words, in which the silent letter is pronounced, such as *candidature*. Additionally, whereas French is relatively easy to read, typically exhibiting one-to-one mappings from orthography to pronunciation, writing is not as easy. To illustrate, the letter pattern *eau* is read as the sound /o/, however, the sound /o/ can be written in a variety of ways, for example, *au, aux, o, ot, os, ô* among others. Choosing the correct spelling for a given sound may be easier for a child if they know which spelling patterns reliably map onto morphological units. While potentially beneficial, little is known about the relationship between morphological skills and writing ability in French (cf. Sénéchal, 2000; Sénéchal, Basque, & Leclaire, 2006; Pacton & Deacon, 2008). Furthermore, we have yet to clarify the potential independent role

of morphology in teaching children to spell in French. In fact, this may be a critical missing link in developing strong French writing skills.

Previous intervention studies suggesting that morphological awareness training can improve children's spelling ability, have not explicitly examined the relative contribution of morphological instruction to spelling ability with that of vocabulary instruction (e.g., St-Pierre & Dubé, 2012). Since morphologically complex words are related to other words in the same word family both in their meaning and in their form, instruction that is not intentionally focused on only the morphological structure of the words will usually involve discussion of word meaning, or morphologically complex words are taught in the context of a vocabulary intervention. To illustrate this overlap, consider the intervention study reported by Lesaux, Kieffer, Falley, and Kelley (2010). Children received instruction on the internal structure of morphologically complex words; however their instruction also included a discussion of what the words mean, and how their meaning relates to the root words. While this instruction led to improved morphological awareness performance, it is not possible to determine if this is due to the instruction of morphological structure, or the discussion of word meanings. While not every morphology intervention explicitly teaches word meaning, there is almost always some degree of vocabulary content concomitant with morphological instruction, given that morphological units represent meaning. Due to the inherent association between morphology and meaning, literacy interventions incorporating the teaching of morphological knowledge conflate this instruction with teaching of vocabulary knowledge. Thus, in order to identify the unique benefit of increasing morphological awareness alone on spelling ability, it is necessary to deliberately contrast instruction focused on morphological structure against vocabulary.

Finally, a crucial step in providing effective instruction about morphemes is to provide this instruction when morphological awareness makes an important contribution to literacy development. Children as young as four years have demonstrated morphological knowledge on production tasks (e.g., Berko, 1958). Furthermore, even younger children, at two to three years, demonstrate knowledge of morphology in diary studies of their novel productions (Clark, 1993) and in recognition of novel morphologically complex words, using intermodal preferential looking (Gonnerman, 2007). However it is not clear when this knowledge begins to influence spelling ability. Some researchers report that morphological knowledge has an early influence as children begin to develop literacy skills (e.g., Deacon & Kirby, 2004; Deacon et al., 2009), 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). As a result, there is uncertainty regarding the most effective age for providing morphological instruction to improve spelling. As acknowledged by Bowers et al. (2010), intervention studies will be important for clarifying exactly when is most beneficial to introduce morphology instruction.

The goals of the current project are thus to understand children's morphological knowledge and its relationship to spelling ability in the primary school years in Quebec. Specifically, the research team will examine the role that morphological knowledge plays in the acquisition of French spelling skills in 3rd- 5th grade students and will use the information gained to identify and develop effective educational tools to assist the classroom teacher in improving spelling competence in French.

PARTIE B – PISTES DE SOLUTION EN LIEN AVEC LES RÉSULTATS, RETOMBÉES ET IMPLICATIONS DE VOS TRAVAUX

The goals of the current project were to assess children's developing knowledge of word structure in French, and to determine whether teaching children about the underlying structure of complex words would help them learn to spell. Given that the writing system of French is particularly opaque with respect to spelling, it is crucially important to the successful development of literacy in French to be able to write words correctly. We also had several subquestions that we wanted to test, including, among others, whether certain types of students would benefit more from training in morphology than others. In particular, would girls benefit more than boys, or vice versa? Would only Francophone children benefit, or would children coming from different language backgrounds also be able to use this type of instruction? Would it only be helpful for older children, or would it work for younger ones as well? Would children who were struggling with spelling already be able to take advantage of specific training in morphological structure, or would it be too difficult for them? These were the main driving questions behind the research program.

Our results point to a definite benefit of the intervention program that we developed. In fact, in only ten weeks, of one-hour-per-week instruction, the children showed up to 40% improvement in their spelling abilities. After the intervention, the third graders were performing as well as the fifth graders had prior to the intervention. Essentially, the 3rd graders jumped two grade levels in spelling ability in 10 weeks! When we went back six months later, the children only forgot about 5% of the words that they had learned. Furthermore, the results held up for all the groups we had wondered about—Francophones and allophones, girls

and boys, younger and older children, good spellers and poor spellers. These results are very promising.

Many questions still remain. For example, could we replicate this positive outcome with another group of students? Can we adapt the training to work for children with more pronounced reading and writing difficulties, such as those with dyslexia? Can we develop a full curriculum that could be implemented in several schools? What type of training would we need to provide to elementary school teachers so that they could deliver this instruction successfully in their own classrooms? Will this type of training produce improvements in reading as well as in spelling? These are just some of the open questions that will need to be addressed in future work to see the full benefits of our training methods can be brought to the largest possible group of children.

As such, this line of research has produced results that will be of interest to scientists working on language processing and the development of literacy. It will also be of interest to those working in education, most directly to people focused on the development of the written language. Finally, it will be of interest to teachers, who work on a daily basis with children who are learning to write and spell in French. It will also be of interest to administrators and policy makers who direct the development of school curricula.s

One aspect of this training that cannot be expressed in the scientific descriptions of the work is the joy in learning that it brought to both the trainers and the students in the classrooms. C'était le fun!

PARTIE C - MÉTHODOLOGIE

To test the role of morphology in spelling, we conducted a randomized control trial using two different instructional emphases, morphology and vocabulary. Both third and fifth grade students participated 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, the other receiving instruction focused on the meanings of the words. For example, the Morphology group learned that there are two parts to the word *finlandais*, namely the stem *finland* and the suffix *-ais*, while the Vocabulary group learned that the word *finlandais* describes something or someone that comes from the country, Finland. Both groups were taught to spell the same set of words, but with the different emphases outlined above. The intervention was given during 10 weekly sessions, each lasting one hour.

Eighty-four children took part in the study, recruited from one elementary school in the greater Montreal area. The primary language of instruction in this school is French. Two fifth grade classes, and two third grade classes took part in the intervention. Each class was divided such that half the children from a given classroom were in the Morphology group, and the other half were assigned to the Vocabulary group. Two teams of one instructor and one assistant were involved in the intervention.

Prior to commencing the intervention, the children were all administered a battery of tests as a group in the classroom assessing spelling, morphological awareness, word meaning, reading comprehension, and receptive vocabulary. The measures were re-administered the week after the final intervention session as post-test measures.

PARTIE D - RÉSULTATS

The primary purpose of our investigation was to isolate the influence of morphological structure training from that of instruction of meaning. 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 findings provide novel evidence that the spelling gains observed in response to morphological instruction is not merely a consequence of the vocabulary knowledge, and that morphological awareness training alone provides an effective and long-lasting contribution to spelling development.

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. 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. To test the statistical significance of the improvements that we observed in the children, we conducted separate planned comparisons for all the tasks that we administered. For each analysis, participants' scores were entered into independent ANOVAs (see Appendices for complete statistical analyses).

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.

We also compared the results for children who demonstrated difficulties with spelling the pre-test and on earlier assessments of their general spelling abilities in French. Overall, our results showed that while all children improved post-intervention, poor readers benefited more than good readers. Crucially, morphological training improved spelling significantly more than vocabulary training did, for both good and poor readers.

One finding of particular interest that I would like to discuss in more detail addresses the question of whether the children in the Morphology group were more likely to spell the final consonant correctly in words that end in silent consonants. This finding highlights the impact of the morphological training on the childrens' thought processes when they are spelling difficult words. Recall that in the introduction we pointed out that one of the major difficulties in learning to spell in French is the fact that French has many silent letters. For example, the word *candidat* ends in the sound /a/, but it is spelled with a final letter t, which is silent in spoken French. How do children know if the word *candidat* is spelled with a t? In fact, many children in our study did not know. On the pretest, we saw errors where children wrote *candida*, or *candidas*. If the children in the Morphology group developed a strategy of thinking of morphologically related complex words when

trying to spell simple stems, they may succeed where the children in the Vocabulary group did not. However, the accuracy results from pre- to post-intervention for the Morphology and Vocabulary groups do not show a significant interaction. Both groups improved significantly from pre- to post-intervention on these items. However, the overall results still do not answer the question whether the Morphology group is more likely to use a morphological strategy to spell these words. To answer this question, we examined the children's errors more closely.

There were approximately 100 errors made by each group in the pre-test, and 80 in the post-test. If children were using a morphological strategy, they might make an error in spelling another part of the word, but still use the correct final consonant. For example, children often spell *orient* with the wrong initial vowel, as in *aurient*, or with the wrong letter before the *n*, as in *oriant*. Additionally, children often leave off the final silent consonant, as in *orien*, or use an incorrect final consonant, as in *orians*. The question, then, is whether children in the Morphology group will be more likely to make errors on other parts of the stem, but still include the correct final *t*. We examined children's errors, and found that children in the Morphology group were 10 percent more likely to use the correct final consonant in the post-intervention test, even if they spelled the stem incorrectly by making an error elsewhere in the word. For the Vocabulary group, children were actually less likely to use the final consonant correctly after the intervention, making four percent more errors on the final consonant in the post-intervention test. These results suggest that the morphological intervention could potentially enable children to generalize beyond words taught in the training and ultimately improve spelling of many words with silent final consonants, a common pattern in French orthography.

In summary, we see that there is a general spelling improvement for all children from pre- to post-intervention. Importantly, the Morphology group showed a greater improvement than the Vocabulary group on the spelling of complex French words. These findings suggest that an instruction that involves explicit decomposition of complex words into stems and suffixes strengthens the representation of these words parts, leading to spelling improvements.

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 was compared to their performance on the test as measured before the intervention as well as immediately after the intervention. We wanted to answer the following specific questions: 1) Is there a difference in relative long-term intervention effectiveness by grade? That is, will instruction that exposes children to morphologically complex words improve long-term spelling performance of children in grade 3 versus 5?; and 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?

Overall, we expected that the children would experience some degree of forgetting, such that their spelling accuracy at the six-month follow-up would be lower than at post-intervention; however we expected that the children would 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 predicted that the greater benefit observed for the morphology intervention would be maintained in the long-term.

Looking more specifically at the long-term outcomes of the intervention, 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) suggesting that, regardless of instruction type, children benefit from a spelling intervention that exposes children to multi-morphemic words.

The findings from our 10-week intervention provide insight into the developmental trajectory of the contribution of morphological processing to literacy acquisition, revealing that children in grade 3 showed a greater improvement in spelling than the children in grade 5 immediately following the intervention. This suggests that an intervention program incorporating morphologically complex words is effective for promoting spelling development, even for younger elementary school aged children. This finding supports Deacon and Kirby (2004), who found that morphological awareness has an early and consistent influence on literacy development. Considering the results from the six-month follow up, while all children demonstrate a small decrease in spelling accuracy, this is not differential based on grade. Thus the initial improvement from intervention displayed by the third graders remains consistent across time. Our study provides evidence for the benefit of introducing morphological training earlier in the developmental process. Given that pre-school aged children have demonstrated knowledge of morphological structure (Berko, 1958; Clark, 1993, Gonnerman, 2007), it is possible that introducing morphological instruction even earlier than grade 3 may contribute to

better spelling performance. Future intervention studies examining children at even younger stages of literacy development are needed to support this possibility.

While it is promising that both types of instruction effectively improve long-term spelling outcomes, the primary purpose of our investigation was to isolate the influence of morphological structure training from that of instruction of meaning.

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 findings provide novel evidence that the spelling gains observed in response to morphological instruction is not merely a consequence of the vocabulary knowledge, and that morphological awareness training alone provides an effective and long-lasting contribution to spelling development.

Given the present evidence for the distinctive role of morphology for children's spelling ability, studies should more closely examine the relative effectiveness of the methods used for teaching children about morphology. Carlisle (2010) categorizes the teaching approaches that have been used for literacy intervention studies into four groups, ranging from explicit teaching of the morphological structure of words, to more implicit instruction using problem-solving methods. Typically, intervention studies combine these approaches, blurring the independent contribution of any one of them. Thus, it is not clear which aspects of morphological training effectively influence a given measure of literacy skill, or if this influence is differential based on a child's age. Moving forward, it will be

important to isolate these methods in order to disambiguate their relative influence on various literacy outcomes at different developmental stages.

PARTIE E - PISTES DE RECHERCHE

The findings from our intervention study provide insight into the developmental trajectory of the contribution of morphological processing to literacy acquisition, revealing that children in grade 3 showed a greater improvement in spelling than the children in grade 5 immediately following the intervention. This suggests that an intervention program incorporating morphologically complex words is effective for promoting spelling development, even for younger elementary school aged children. It is possible that introducing morphological instruction even earlier than grade 3 may contribute to better spelling performance. Future intervention studies examining children at even younger stages of literacy development are needed to support this possibility.

Findings from our 6-month follow-up study provide support for an advantageous role of morphology instruction for spelling outcomes in Quebec French. 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. Thus, an intervention combining instruction of morphological structure and vocabulary knowledge may be especially helpful for younger children, an important possibility to be explored in future literacy intervention research. Finally, our results show that morphological training helps children who are struggling with spelling, highlighting a need for intervention studies to assess potential benefits for children with dyslexia.

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