

Morphological awareness intervention: does severity play a role in spelling/reading improvement?

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Children with written language difficulties are characterized by low morphological awareness (MA) skills. Intervention studies show significant improvement in reading/spelling skills following MA training. However, no data are available on the effect of this intervention when taking into account the degree of severity of the children's difficulties. Objective: To document MA intervention's impacts on reading/writing skills based on the severity of the difficulties experienced by second grade French-speaking children. Thirty-seven children participated in this randomized intervention study with pre/post intervention measures. Children were classified in two groups according to the severity of their difficulties at T1. Significant improvement in standardized tests of reading/spelling and learning retention were found, especially for children with severe difficulties. An overall improvement was obtained for 75% of the children with a "severe" profile with an improvement to a "mild-to-moderate" profile immediately and six months after the end of the intervention. These results highlight the importance of intervening as early as 2nd grade and of targeting MA in children with reading/spelling difficulties to maximize their literacy acquisition.

Keywords: Intervention, morphological awareness, spelling, written language difficulties, severity.

Intervención sobre la conciencia morfológica: ¿incide la severidad en la mejora de la ortografía/lectura? Los niños con dificultades en el lenguaje escrito se caracterizan por un déficit en las habilidades de conciencia morfológica. Los estudios sobre intervención muestran una mejora significativa en las habilidades de lectura/ortografía después del entrenamiento en conciencia morfológica. Sin embargo, no hay datos disponibles sobre el efecto de esta intervención si se tiene en cuenta el grado de severidad de las dificultades de los niños. Objetivo: Analizar el impacto que la intervención en la conciencia morfológica tiene sobre la lectura / escritura, teniendo en cuenta la gravedad de las dificultades experimentadas por los niños de segundo grado de habla francesa evaluados. Treinta y siete niños y niñas participaron en este estudio de intervención aleatorizado, con evaluaciones pre / post. Los niños fueron clasificados en dos grupos de acuerdo a la gravedad de sus dificultades en T1. Se obtuvo una mejora significativa en pruebas estandarizadas de lectura / ortografía y de retención de aprendizajes, sobre todo en los niños con dificultades graves. Se observó una mejora generalizada en el 75% de los niños con un perfil "severo" con una mejora de "leve a moderada" inmediatamente y seis meses después del final de la intervención. Estos resultados resaltan la importancia de intervenir en cursos tan tempranos como 2º grado y de centrarse en la conciencia morfológica en niños con problemas de lectura / ortografía para maximizar su adquisición de la lectura y la escritura.

Palabras clave: Intervención, conciencia morfológica, ortografía, dificultades del lenguaje escrito, gravedad.

Five to 17% of school-age children fail to develop written language skills corresponding to their age (Snowling, 2000). A child's strengths and weaknesses in oral language strongly modulate the magnitude and the

persistence of his/her difficulties in this area of learning. More specifically, morphological skills play a key role in learning to spell, and these difficulties significantly hinder the development of spelling. A targeted intervention of morphological awareness brings significant improvement in spelling. However, the gains have never been linked with the severity of the difficulties experienced by children.

It is well known that a phonological processing deficit (i.e., difficulties to analyse the sounds of words) hinders spelling set up and its automatized use. This deficit affects the development of morphological skills that play a role in the spelling learning process, especially after a few years of schooling (Carlisle, 2004). A child with low morphological awareness skills shows a limited knowledge of the internal structure of words and the relationship they have with each other within a sentence. He/she has difficulties to recognize the significant elements that compose a word and hardly uses this information orally and in the various areas of writing. Low morphological awareness (MA) skills, i.e. the ability to think about and voluntarily manipulate the smallest units that carry meaning in words (morphemes), characterize children with written language difficulties (Casalis & Louis-Alexandre, 2000). This has implications for the right use of inflectional markers (Joanisse, Manis, Keating, & Seidenberg, 2000), for instance, for gender agreement: "Le petit garçon" ("The little boy") vs. "La petite fille" ("The little girl"); and derivational markers: "fille" (girl) vs. "fillette" ("little girl"). These difficulties hinder the literacy acquisition in languages like French, where morphology is encoded in spelling. This lack of knowledge of morphological markers subtly affects oral speech but causes very important difficulties in written language (Carlisle, 1987). Unless there is an intervention, these morphological difficulties and their impact on spelling skills persist beyond primary school (Nagy, Berninger, Abbott, Vaughan, & Vermeulen, 2003).

Since the use of morphological markers in spelling is a challenge for children with written language difficulties, an intervention specifically targeting these skills can help them meet the school's syllabus requirements. Studies on MA

intervention are still few and have an exploratory nature. However, intervention studies targeting MA have shown significant improvement in reading and spelling in children who received this training. It leads children to think about, analyze and voluntarily manipulate the morphological elements in a word. This intervention may be carried out in the classroom or take the form of a specialized training program. In both cases, intervention studies conducted since 2000 by St-Pierre (2009) show significant gains in word recognition and spelling skills in children with and without difficulties. The effects obtained are specific -an explicit work in the field of morphology is present immediately and particularly during the development of morphological abilities. These changes are not the result of a general effect of intervention (i.e., the Hawthorne effect), but are distinct from those obtained after training in phonological awareness (Casalis & Colé, 2009).

Although studies on MA became more frequent in the past decade, the information currently available on the nature of morphological difficulties and their relation with spelling in children with written language difficulties is insufficient, and its clinical implications remain unexplored. In fact, several aspects related to the child himself remain to be investigated in order to achieve a targeted MA training appropriate to the needs of children in difficulty in different languages and ages. Thus, the impact of training in MA among speakers of scripts/orthographies in which morphology is encoded in spelling, such as in a language like French where grammar agreement (flexional morphology) is particularly rich and complex, remains poorly documented.

In addition, several studies have documented the effects obtained with children with written language difficulties older than nine years of age. The impact of MA training to promote optimal learning to spell and prevent further problems in early schooling children (7-8 years) has only been slightly studied until now. Finally, apart from the general impact of a targeted intervention, no data are available on the evolution of the degree of severity of children's written language skills following an MA training. This could enable to show, from a

clinical standpoint, the effectiveness of this intervention and to highlight the characteristics of children who benefit most from this training through their response to intervention. Consequently, this could lead to more targeted interventions and activities to help children with written language difficulties from various professional fields such as speech language pathology, special education, and teaching.

Objective: This study documents the impact of a MA training on reading/writing skills based on the severity of the difficulties experienced by second grade French-speaking children. We hypothesize that the severity of difficulties in written language modulates the magnitude of improvement observed in children after the intervention. However, the absence of information on this regard (i.e., severity) prevents us from giving a direction to this hypothesis.

Method

Participants

A randomized intervention study was conducted. Thirty-seven children (25 boys) aged 7-8 years old who showed reading and spelling difficulties participated in the study. All participants were recruited from schools in the Quebec City area. All children were French-speaking; one child had repeated a school year, and no children had a documented history of language or neurological disorders. Finally, all participants attended second grade in regular schools. Informed consent for participation in this study was obtained from the parents of all participants prior to testing. This study received ethical approval from Laval University and the Institut de réadaptation en déficience physique de Québec. Children were first identified by their teacher. The difficulties were confirmed by standardized tests of word identification and spelling (performance below the 16th percentile rank). Forty-six children were initially recruited, but four were eliminated after testing because their performance placed them in the low average, three dropped out during training because of motivation or behavior problems, and two changed school before the end of the study. Out of the 39 children that started the study, 37 completed it.

Intervention

Two MA training (flexive morphology) were offered to children. The first one dealt specifically with the handling of oral morphological agreement of words and its relation with spelling. It was an explicit training. The second training concerned morphology but dealt with the classification of words and spelling. This training was more implicit than the first one.

Both had exactly the same structure and used controlled stimuli in terms of morphology. Training included adjective and verb agreement (gender/number/tense). The children were randomly distributed to one of the two MA trainings. The intervention was conducted at school during ten weeks, with 2 to 3 40-minute periods a week and in groups of 3 to 6 children. Both trainings were conducted by the same speech language pathologist. None of the children had received professional services during the intervention.

Measures

All children participated in a set of standardized and experimental tasks designed to assess written language (word recognition/spelling), metaphonological abilities, metamorphological abilities, and cognitive function. Tests were administered individually in a quiet room at the child's school and were conducted over two sessions, each one lasting about one hour for a total of two hours per child. The measurements were carried out three times: before training (T1-pre-intervention), immediately after training (T2-post-intervention), and 6 months after training (T3 - post-intervention).

Standardized tests: Written language was assessed with five subtests of the Belo (Georges & Pech-Georgel, 2006): regular and irregular word recognition (speed/accuracy), text comprehension (reading speed/accuracy; comprehension questions), single word spelling and word spelling in sentence context. A total of nine measures of written language were administered. Morphological abilities were assessed with a subtest of CELF^{CDNF} - adaptation of CELF 4 (Semel, Wiig, & Wayne, 2003)-, and morphological and phonological awareness were assessed with experimental tasks (Roy,

2008; St-Pierre & Beland, 2010). Non verbal analogical reasoning was assessed with a subtest of the WASI (Weschler, 1999).

Baseline: A spelling task and an oral sentence completion task (morphological awareness) composed of 40 simple sentences (S-V-C) were developed. The stimuli were selected according to the characteristics of the trained lexical categories and morphological markers. Half of the stimuli were practiced items during training while the other 20 were novel ones (but equivalent in terms of frequency, length, and phonological/morphological complexity).

Children who obtained a score below the 16th percentile rank in at least three of the nine reading measures at T1 were selected for this study. The children's teacher and parents corroborated the observed difficulties. Children were classified according to the severity of their difficulties in written language as measured at T1. Performance below the 5th percentile on standardized tests was considered as severe impairment (SI), while a score between the 6th and 16th percentile was considered as mild to moderate impairment (MI). In addition, an overall profile of performance in reading/spelling with results from more than five out of eight measures below the 5th percentile (accuracy and speed) was considered severe (SI; $N=24$). Scores below the 5th percentile on four measures or less were classi-

fied as a mild to moderate impairment (MI; $N=13$). The text comprehension measures were excluded here because mechanisms underlying this task were quite different from those of word recognition/spelling.

Results

Given that the improvement achieved by children at the three times of measurement were similar in both interventions (St-Pierre, Dubé, Croteau, Bourque, & D-Plourde, 2012), the results of the 37 children were analyzed together. Friedman test shows that the severity of difficulties has changed significantly after training ($\chi^2 = 36.857, p < .001$). Wilcoxon multiple comparisons analyses indicate that the severity decreased significantly immediately after intervention (T2) ($Z = -4.583, p < .001$) and that it has remained stable after six months (T3) ($Z = 1.732, p = .083$). This improvement was not the same for all children. It varied in severity according to their profile at T1. Figures 1 and 2 show the average performance as a function of severity.

Have showed in Figures 1 and 2, ANOVA analyses revealed that SI children showed significant improvement of their performance right after the training (T2), with learning retention in word recognition (accuracy and speed) and spelling (single word and sentence)

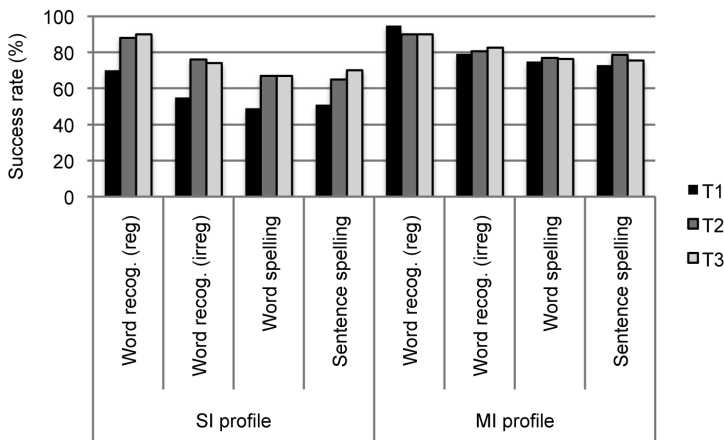


Figure 1. Average Performance (%) at T1 to T3 in written language tasks, as a function of severity.

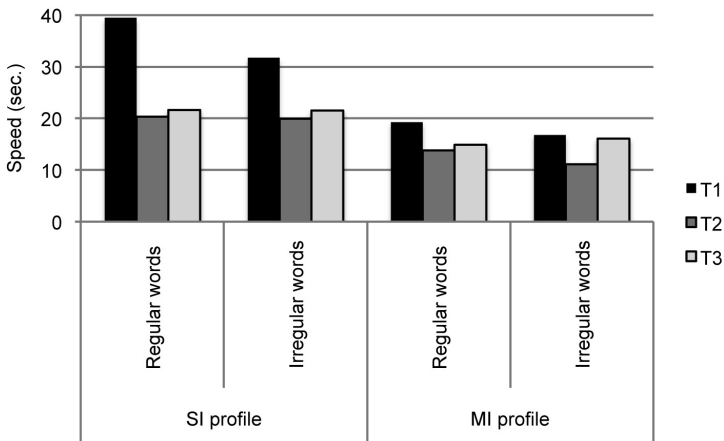


Figure 2. Average speed (seconds) at T1 to T3 in reading tasks, as a function of severity.

six months later (T3). That was not the case for MI children. This group showed a significant improvement of their performance in regular word recognition (speed and accuracy), regular word recognition (speed) and sentence spelling right after the training (T2), but only the improvement in irregular word recognition (speed) stayed significant six months later (T3) (see Table 1 for *t* and *p* values).

In addition, a Cochran's *Q* test was used to measure severity changes in frequencies (proportions) across time (number of children according to their complete profile before and after intervention). As showed in Figure 3, 24 out of 37 children had a SI profile at T1. Post-intervention (T2), three children remained with a SI profile while 21 progressed to a MI profile. Six months after intervention (T3), 31 chil-

Table 1. Comparison between performances in standardized tests, as a function of severity

TASKS		DEGRE OF IMPAIRMENT	
		SI	MI
Regular word recognition	Accuracy	T1/T2: $t_{(15)} = -5.406; p < .001^{**}$ T2/T3: $t_{(15)} = -0.689; p = .502$ T1/T3: $t_{(15)} = -7.251; p < .001^{**}$	T1/T2: $t_{(15)} = 3.576; p = .003^*$ T2/T3: $t_{(15)} = 0.000; p = 1$ T1/T3: $t_{(15)} = 1.525; p = .144$
	Speed	T1/T2: $t_{(25)} = 8.272; p < .001^{**}$ T2/T3: $t_{(25)} = 1.219; p = .234$ T1/T3: $t_{(25)} = 6.807; p < .001^{**}$	T1/T2: $t_{(10)} = -4.065; p = .002^*$ T2/T3: $t_{(10)} = -0.873; p = .403$ T1/T3: $t_{(10)} = 2.857; p = .017^*$
	Accuracy	T1/T2: $t_{(24)} = -12.338; p < .001^{**}$ T2/T3: $t_{(24)} = -0.558; p = .582$ T1/T3: $t_{(24)} = -7.025; p < .001^{**}$	T1/T2: $t_{(11)} = -5.18; p = .615$ T2/T3: $t_{(11)} = 0.561; p = .586$ T1/T3: $t_{(11)} = -1.047; p = .318$
Irregular word recognition	Speed	T1/T2: $t_{(22)} = 6.123; p < .001^{**}$ T2/T3: $t_{(22)} = -0.949; p = .353$ T1/T3: $t_{(22)} = 4.448; p < .001^{**}$	T1/T2: $t_{(12)} = 6.95; p < .001^{**}$ T2/T3: $t_{(12)} = 2.912; p = .013$ T1/T3: $t_{(12)} = .364; p = .722$
	Word spelling	T1/T2: $t_{(19)} = -6.395; p < .001^{**}$ T2/T3: $t_{(19)} = 1.453; p = .163$ T1/T3: $t_{(19)} = -7.935; p < .001^{**}$	T1/T2: $t_{(16)} = -0.838; p = .415$ T2/T3: $t_{(16)} = -0.148; p = .884$ T1/T3: $t_{(16)} = 0.566; p = .579$
	Sentence spelling	T1/T2: $t_{(8)} = -4.733; p < .001^{**}$ T2/T3: $t_{(8)} = 1.123; p = .294$ T1/T3: $t_{(8)} = -5.708; p < .001^{**}$	T1/T2: $t_{(27)} = -3.535; p = .001^*$ T2/T3: $t_{(27)} = 1.499; p = .146$ T1/T3: $t_{(27)} = -0.981; p = .335$

* $p < 0.05$ ** $p < 0.01$

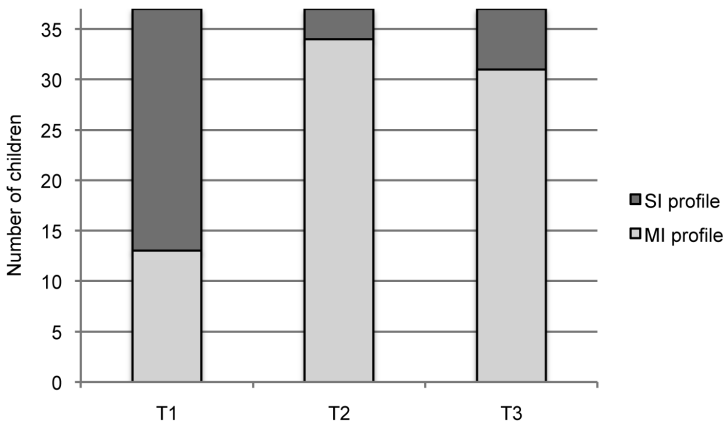


Figure 3. Number of children in each of the severity profiles as a function of time

dren still had a MI profile. The distribution of children according to the severity of their overall profile was significantly different among the three measurement times ($Q = 29.059, p < .001$).

Discussion

The aim of this study was to document the impact of morphological awareness training on reading/writing skills based on the severity of the difficulties experienced by second grade French-speaking children.

It appears that an intensive structured intervention focused on morphology allows for a significant improvement in reading and writing skills in children with written language difficulties. This improvement is evidenced by a reduction of severity after training as measured by standardized clinical tests. This reduction of variation from the norm is maintained six months after intervention and let us think that this training enabled children to make achievements that they continue to reinvest in their development and consolidation of written language. A closer analysis of this improvement emphasizes that the MA training is especially useful for children with severe difficulties in reading and writing. Although all children had gains in word recognition and spelling, the improvement was more salient

(i.e., in a greater number of tasks) in SI children compared to MI children with improvement to a “mild to moderate” profile.

Therefore, it seems appropriate to provide an intensive structured intervention focused on morphology to small groups, of children with highly significant written language difficulties. Even if this “pre-determined” intervention cannot be adapted to the particularities of every child, it allows to focus on the basic elements of word recognition and spelling that were underexploited or poorly consolidated for all of them. Children with less severe difficulties, and more heterogeneous profiles, seem to need more adapted intervention, adjustable to consider their strengths/weaknesses and their progress rather than a systematic application of a “wall to wall” program.

This 10-week intervention enabled 40% of the children to achieve the standard second grade level when their skills were measured immediately after and six months after intervention. When children are compared to themselves, the response to intervention is considered particularly satisfactory. Twenty-four percent of children had a small responsiveness to intervention, so the gains made failed to be observed as an improvement in the severity of their difficulties. Another intervention or an intervention more suited to their specific needs would have been required.

Conclusions

A structured, intensive and morphology-focused treatment allows for a significant improvement in reading and writing skills in early school children (second grade). This MA intervention optimizes the development of reading and spelling competences in French, a language in which morphology is encoded in spelling. A reduction in the severity of the difficulties was ob-

served after training, and is maintained six months after intervention. This MA intervention promotes the development of word recognition and spelling skills in a particularly convincing way in children who had severe difficulties at the beginning of the intervention. These results highlight the importance of intervening early and of targeting morphological awareness with children who have reading/spelling difficulties in the early years of schooling.

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