Read Writ (2016) 29:659–681
DOI 10.1007/s11145-015-9620-x

The spelling strategies of francophone dyslexic students

Noémia Ruberto[1] · **Daniel Daigle**[1] · **Ahlem Ammar**[1]

Published online: 5 January 2016

Abstract The development of spelling skill is a very difficult task for students with dyslexia. Spelling in French involves the consideration of various types of knowledge, procedures and strategies. This study aims to describe the spelling strategies of 32 dyslexic students (DYS) aged from 8 to 12 years and to establish links between spelling strategies and spelling skill. Students had to spell 24 dictated words and provide comments on the strategy employed for each word. The performances of DYS were compared to 25 children of the same chronological age (CA) and of 24 children of the same reading age (RA). The results show that phonological strategies are the most commonly used by all groups of participants. If no particular strategy is related to the spelling skill of DYS, visuo-orthographic strategy generally accounts for the spelling skill results of CA and RA.

Keywords Dyslexia · Spelling · Spelling skill · French · Spelling development · Word production

Introduction

For most western school systems, the first objective is to give all students opportunities for success. This success depends largely on mastering written language (Daigle & Montésinos-Gelet, 2013; Graham, Harris, & Chorzempa, 2002).

✉ Noémia Ruberto
noemia.ruberto@umontreal.ca

Daniel Daigle
daniel.daigle@umontreal.ca

Ahlem Ammar
ahlem.ammar@umontreal.ca

[1] Département de didactique, Université de Montréal, CP 6128, Succursale Centre-ville, Montréal, QC H3C 3J7, Canada

Indeed, learning written language is a major social and personal factor in academic achievement (CSÉ, 2008; Lin, 2013). Even if spelling is only part of the writing process, the evaluation of students' written skills will often be based largely on spelling performance (Daigle & Montésinos-Gelet, 2013; Graham et al., 2002). In fact, spelling is a significant challenge, especially for children with a learning disability like dyslexia (Sprenger-Charolles & Colé, 2003). Dyslexia is a learning disability that affects word recognition in reading and word production in spelling (INSERM, 2007; Lyon, Shaywitz, & Shaywitz, 2003) and is generally considered to be the result of a deficit in phonological information processing (Goswami, 2002; Snowling, 2000). This phonological deficit directly impacts the development of the alphabetic principle according to which, ideally, each phoneme (or sound) corresponds to a grapheme (a letter or a group of letters). Phoneme-grapheme correspondences constitute to a basic and central process in the acquisition of spelling in French and in other alphabetic languages (Ehri, 2005; Plisson, Daigle, & Montésinos-Gelet, 2013; Seymour, Aro, & Erskine, 2003).

Spelling skill can be defined as the ability to spell a word correctly (Daigle & Montésinos-Gelet, 2013; Treiman & Bourassa, 2000). To become an expert in an alphabetic language, writers must develop knowledge of the orthographic code (Alegria & Mousty, 1996; Carrillo, Alegría, & Marín, 2012; Daigle & Montésinos-Gelet, 2013; Treiman & Bourassa, 2000). One of the first things the writer needs to learn is that the alphabetic writing system is based on the alphabetic principle. In an ideal world, the spelling system would be transparent, that is, the correspondence between sounds and letters would be absolute. For each phoneme, there would be a single corresponding grapheme, and vice versa. However, spellers cannot rely only on the alphabetic principle to spell correctly in languages like English and French, in which there are many exceptions to the alphabetic rule. For example, in French the number of graphemes is much larger than the number of phonemes (130 graphemes vs. 36 phonemes), and therefore, it is not always easy to choose the correct spelling. This means that a phoneme may correspond to several graphemes and a specific letter may correspond to different sounds. For example, the sound [o] can be written /o/,/au/,/eau/. In contrast, a grapheme may also correspond to several phonemes, like the grapheme /ch/ which is pronounced [ʃ] in the word *chien* (dog) and pronounced [k] in the word *charisme* (charisma). In addition to the alphabetic principle, children must also become familiar with word properties to develop good spelling skills. In French, word structures are guided by phonological, morphological and visuo-orthographic properties (for a complete description, see Daigle & Montésinos-Gelet, 2013).

In addition to knowing about the alphabetic principle and the specific properties of the language, children must also acquire knowledge about the different procedures and strategies needed for orthographic production to develop good spelling skills (Daigle & Montésinos-Gelet, 2013; Treiman & Bourassa, 2000). Here it is important to make the distinction between procedures and strategies. In fact, both terms refer to the same mental operation, but they are not used in the same context. When writers need to spell a word from memory, they are using a *procedure*. A *procedure* refers to something automatic, effortless, and unconscious (Besse, 2000; Raynal & Rieunier, 2005). However, when writers must produce a

word that they do not know or do not know how to spell correctly, they face an orthographic problem. To overcome the problem, they must consciously use a *strategy* (Legendre, 2005; Tardif, 1992). According to Fayol and Jaffré (2008), those who are most successful in spelling are those who have acquired more strategies and apply them wisely. That is why it is important to ensure that children know different spelling strategies and use them effectively (Fayol & Jaffré, 2008). In other words, to develop expert spelling skills, writers must acquire a set of strategies that will enable them to act appropriately in the various tasks that they are expected to achieve.

Theoretical models of spelling skill acquisition generally do not distinguish between procedures and strategies. Nevertheless, it is important to discuss key theoretical models/approaches to spelling development to point out the operations that writers must use to develop expert spelling skills.

Traditional stage models suggest that children's development of reading and spelling go through a series of stages or phases, which are each marked by the adoption of a particular procedure (Frith, 1985, 1986; Ehri, 1999, 2005). In these models, two main procedures are taken into account. First, there is a graphophonological procedure which corresponds to the children's phonological attempts to decode words or to produce a written word that would be phonologically plausible. Second, there is an orthographic procedure where children consider spelling constraints and morphological aspects of the language. Stage models seem incomplete because other well known procedures are not taken into account. Indeed, operations such as analogy, which refers to the process of using known words to spell unknown words that share orthographic similarities, are well documented (Bosse & Pacton, 2007; Goswami, 2002) but they are not integrated into these models.

Also, in stage models, the order of acquisition is very strict: children must master a specific stage in order to move to the next one and develop more advanced skills. Such models lack flexibility in the activation of processes by which children initially learn to spell (or read). In fact, in early learning, children use a variety of procedures, either in reading or in spelling, of different levels of effectiveness (Boulc'h, Gaux, & Boujon, 2007; Rittle-Johnson & Siegler, 1999; Snowling, 1994).

Siegler's (1996) overlapping waves model of development (OWM) provides further evidence for acknowledging flexibility in children's strategy choices early in literacy development. This model suggests that children rely more on certain strategies at different points in time. According to the task that children must perform, certain strategies would be preferred because they appear the most effective for achieving this task compared to other strategies (Farrington-Flint, Stash, & Stiller, 2008; Rittle-Johnson & Siegler, 1999; Steffler, Varnhagen, Friesen, & Treiman, 1998; Varnhagen, McCallum, & Burstow, 1997). These shifts in preferred strategies often reflect children's growing sensitivity to more word-specific orthographic features, such as orthographic complexity and word length, which have a significant effect on the correct spelling of words (Écalle, 1998; Treiman, 1993). Regarding orthographic complexity, it is possible to assume that words of minimal complexity will be better spelled because they can be written correctly with the use of a phonological strategy (which involves phoneme-

grapheme correspondences). Indeed, empirical data also have indicated that most errors are phonologically plausible (Daigle & Montésinos-Gelet, 2013; Plisson et al., 2013). Furthermore, length of words may also explain spelling skill. In fact, short items seem less demanding in terms of cognitive resources associated with short-term memory. In fact, empirical data have indicated that short items cause fewer errors than long items (Foulin, 1997; Lété, Peereman, & Fayol, 2008).

Considering what has been said, it seems appropriate not to try to make children's spelling performances fit into a specific developmental stage but to consider their use of spelling strategies in the light of specific characteristics of words.

The study of spelling strategies

Researchers have investigated spelling strategies in English (Darch, Kim, Johnson, & James, 2000; Devonshire & Fluck, 2010; Farrington-Flint et al., 2008; Harrison, 2005; Rittle-Johnson & Siegler, 1999; Sharp, Sinatra, & Reynolds, 2008; Steffler et al., 1998) and in French (Alegria & Mousty, 1996; Sénéchal, 2000; Sénéchal, Basque, & Leclaire, 2006; Sprenger-Charolles, Siegel, & Bonnet, 1998). Among all these studies, only one has been conducted with children with dyslexia, however, and it was in French (Alegria & Mousty, 1996).

To describe the spelling strategies used by children, most of the studies cited above used students' retrospective verbal reports about the spelling strategies that they used to produce a word. In the other studies the strategy or procedure used by children has been inferred by considering children's spelling mistakes (Parent & Morin, 2005; Rittle-Johnson & Siegler, 1999). This last method has not been effective because it does not really allow investigation of the strategies. First, by considering only incorrect spellings, there is no data on the strategies that helped to correct spellings. Second, it allows the possibility of formulating hypotheses about spelling strategies, but it cannot insure that the inferred strategies really correspond to what children did. In other words, there is no way to know with certainty by analyzing only one simple word which spelling strategies were used by the children (Devonshire & Fluck, 2010). It is for these reasons that the use of retrospective verbal reports seems relevant for studying spelling strategies (Ericsson & Simon, 1993). Unlike the study of Alegria and Mousty (1996) conducted with French children with dyslexia, the present study included verbal reports.

Even if a wide range of typologies have been developed, some terms occur frequently. One of the most commonly found strategies in the literature is *direct retrieving from memory.* This strategy allows the child to access automatically the features of the word from memory in order to spell it correctly. However, if we rely on the definition of "strategy" that was given previously, we cannot consider *direct retrieving from memory* as a strategy. In fact, if the young writer has automatic access to the characteristics of the word in memory, the process should be considered a procedure and not a strategy. Other strategies commonly found in the literature include first, the *phonological* strategy, which refers to the use of sounds to spell words correctly (e.g., I separate the word into sounds or syllables.). Second, the *visuo-orthographic* strategy consists of checking if the written word seems correct visually (e.g. The word *femme*—woman—looks better written this way than as *feme.*). The

third type of strategy, *analogy*, refers to when a writer uses another known word to help write the word to be spelled (e.g., I take the word *quatre*—four—to help me write the word *quatorze*—fourteen). Finally, the last type of strategy is termed *backup*. It is the application of a personal mnemonic device for one specific word (e.g., *Toujours* prends toujours un –s à la fin—Always is always written with an –s at the end).

Results from these studies have shown that, among these four strategies (phonological, visuo-orthographic, analogy and backup), the one that is most used is the phonological strategy, either for typically-developing children or for children with learning difficulties (Devonshire & Fluck, 2010; Farrington-Flint et al., 2008; Rittle-Johnson & Siegler, 1999; Sénéchal et al., 2006; Sharp et al., 2008; Steffler et al., 1998). Also, the efficiency related to the use of different strategies seems to vary widely from a study to another (Farrington-Flint et al., 2008; Harrison, 2005; Rittle-Johnson & Siegler, 1999; Sénéchal et al., 2006; Steffler et al., 1998). These results, obtained from studies mainly carried out in English, are certainly very interesting and work on other languages must be encouraged. Out of the very few studies conducted with French-speaking children, only one study was conducted in a sample of learners with dyslexia (Alegria & Mousty, 1996). We are not aware of any data collected in this population through verbal protocols.

In studies cited earlier, most researchers have used dictation tasks. The use of dictation tasks instead of written production tasks to collect participants' retrospective verbal reports about the strategies that they use may be explained by the fact that a written production task is much more complex than a dictation task. In written production, children must consider a variety of factors: the intent of writing, the selection of both general content and specific ideas, the organization of ideas, and so forth. For this reason, the use of dictation seems more appropriate for studying spelling strategies and collecting retrospective verbal reports related to these strategies.

Considering the findings described above, this study attempted to answer the following questions:

1. Do word properties (complexity and length) affect the production of written words of francophone students with dyslexia?
2. Which types of strategies do francophone students with dyslexia adopt for word production?
3. Which strategies are the most effective in a dictation context?
4. Are all spelling strategies equally related to participants' spelling skills (as measured by the *Written narrative task*)?

Methods

Participants

In total, 81 children aged 8–12 years participated in this study. They all had French as their first language and were enrolled in a francophone school. A general

Table 1 Distribution of participants within groups

	DYS ($n = 32$)	RA ($n = 24$)	CA ($n = 25$)
Mean chronological age (*SD*)	11.34 (.87)	10.00 (1.14)	11.44 (.77)
Mean reading age (*SD*)	9.91 (1.65)	9.83 (.96)	12.28 (.79)
General cognitive abilities Raven's matrices (*SD*)	86.98 % (3.70)	86.13 % (6.39)	85.49 % (5.30)

cognitive abilities test, *the Raven matrices* (Raven, 1998), was administered to ensure that none of the participants had cognitive disabilities. No participant had to be excluded based on the results of the cognitive abilities test.

Out of these participants, 32 children had been diagnosed by speech specialists with profound dyslexia (DYS), that is to say that participants had both phonological and surface dyslexia (for a complete description, see Sprenger-Charolles & Colé, 2003). These DYS students were compared to two control groups. A first group was composed of 25 children of the same chronological age (CA) as DYS. A second group was formed by 24 younger children that were the same reading age (RA) as DYS. Because the diagnosis of dyslexia is mainly determined by a deficit in reading and because writing is closely linked to reading, we matched DYS and RA participants based on reading age measured with a subtest of the K-ABC battery (Kaufman & Kaufman, 1993). This dual pairing allows some explanations to be provided about a potential developmental trajectory, whether the spelling difficulties are related to a learning delay or a deviant pattern of development (Casalis, 2003). Data related to participants are presented in Table 1.

We conducted group comparisons through a series of statistical analyses. The first ANOVA, for chronological age, indicated an age effect, $F(2, 78) = 18.85$, $p < .001$, $\eta^2 = .33$. Tukey post hoc analysis showed that DYS were older than RA ($p < .001$) and that DYS were the same age as CA ($p = .921$). Also, CA were older than RA ($p < .001$). The second ANOVA, for reading age, revealed a reading effect, $F(2, 78) = 32.221$, $p < .001$, $\eta^2 = .45$. Tukey post hoc analysis showed that DYS had the same reading competency as RA ($p = .974$), but obtained lower scores than CA ($p < .001$). RA also achieved lower scores than CA ($p < .001$).

Measures

Written narrative task

The first measure, the *Written narrative task*, evaluated participants' general spelling skill. In this task, participants had to produce a text where ideas were explicitly given and where many words that might potentially appear were also provided. As cognitive efforts related to higher-level processes were minimized, this allowed participants to focus more on spelling.

A passage from a children's story book was read to participants, and they were then asked to make an oral summary. To assist them, the experimenter asked questions about, for instance, the name of the characters, where the story took place,

and so forth. After participants had finished making the oral summary, they were invited to write the story as accurately as possible. There was no time limit, but participants took on average 30 min to complete the task.

Spelling dictation task

The second measure, the *Spelling dictation task*, was conducted a few days after the first task to collect participants' retrospective verbal reports about the strategies that they used. It used a mixed protocol involving written and oral components. For this test, participants had to write 24 dictated words (see "Appendix"). To make sure that the dictated words were orally known by the participants, a bank of frequent words was first created. To create the word bank, the lexical database *Manulex* (Lété, Sprenger-Charolles, & Colé, 2004) and some textbooks designed for first and second graders were used (Cauchon, Jutras, & Létourneau, 2001; Gaouette & Renaud, 2000; Lachapelle & Péladeau, 1999). In total, 24 words were selected and pretested with 23 children aged 7 and 8 years. Children had to show the picture, out of four pictures, that corresponded to the word that they heard. All experimental items selected for inclusion were orally known by all participants.

The experimental items were chosen according to two different variables: orthographic complexity and length. First, the chosen words varied in terms of orthographic complexity. Three complexity levels were defined and words were equally distributed across levels (8 in each level). For an item to be of *minimal complexity*, spelling had to be regular (e.g., most common phonographemic connections: *ami*—friend). A word of minimal complexity could also contain a silent /e/ if this silent /e/ was preceded by a consonant at the end of the word (*lire*—to read). For an item to be of *medium complexity*, the word had to contain one spelling difficulty (e.g., a less frequent phoneme-grapheme correspondence: *main*—hand, a double consonant: *pomme*—apple) and could also contain a silent /e/ if the silent /e/ was preceded by a consonant at the end of the word (*quatorze*—fourteen). Finally, for an item to be of *maximum complexity*, the word had to contain at least two spelling difficulties (e.g., a less frequent phoneme-grapheme correspondence, a morphogramme or silent letters different from the final /e/: *habit*—costume). An item with an atypical spelling pattern (*orchestre*—orchestra) was also considered as a word of maximum complexity. Second, the selected items also varied according to their length. Short words (n = 12) had two written syllables while long words (n = 12) had three written syllables. The long words also contained more graphemes than the short words.

Two practice items were provided to participants so that they could familiarize themselves with the experimental procedures. The experimenter pronounced the word once. Then, to check if the word made sense to the participants, the experimenter showed them four pictures and asked them to point to the one that matched the word that had been spoken. Once this was done, the word was dictated a second time by the experimenter and was written by the participant. Finally, the experimenter asked the participant, "Tell me what you did to write the word." If no response was provided, the experimenter asked the question, "How did you figure out the spelling of the word ____?" Still, if the participant did not know what

to answer, one last question was asked, "Why did you write the word this way?" If, after asking these three questions, the participant replied that he did not know what strategy he used or that he simply did not respond, the experimenter moved forward with the next word. No strategies were proposed in these prompts in order to avoid any influence on retrospective verbal reports of participants. These reports were recorded on audiotape to facilitate their analysis.

Analysis

Written narrative task

The recording of the production of each participant was transcribed on a computer prior to calculating a general spelling score for each participant. To calculate the spelling score, each word was segmented into graphemes, and each grapheme produced was compared to the expected grapheme. This grapheme analysis led to a grapheme success rate (%), which corresponded to the general spelling score for each participant. Table 2 illustrates how the production of the word **batto* (instead of *bateau*—boat) was analyzed at the grapheme level. The digit 1 was attributed in the Success column when the written grapheme corresponded to the expected grapheme or in the Error column when an error was made.

Here, the grapheme analysis revealed that there were two errors in this four-grapheme word. The participant then obtained 2 out of 4, which meant that the grapheme success rate was 50 % for the word *batto*. However, as the objective of this paper was not to present in detail the results of the written production but to provide a general spelling score against which the use of spelling strategies could be compared, only the general score will be reported in the "Results" section.

All texts were analyzed and all errors coded by two different research assistants. The agreement between scorers was very high (over 95 % for all groups).

Spelling dictation task

As stated earlier, participants had to write 24 dictated words. In order to conduct data analysis, the words written by the participants were entered into the computer and then the words were scored. If the word was spelled correctly, one point was awarded. Conversely, if the spelling was incorrect, no points were given.

To collect feedback on participants' spelling strategies, retrospective verbal reports were obtained. In fact, after spelling each word, participants were asked to

Table 2 Graphemic analysis example

Expected graphemes	Written graphemes	Number of written graphemes	Success	Errors
b	b	1	1	
a	a	1	1	
t	tt	1		1
eau	o	1		1

explain what they had done to spell it. We considered participants' retrospective verbal report only for words that were correctly written.

Retrospective verbal reports were first classified into three main categories:

- The first category concerned retrospective verbal reports that were *irrelevant, inaccurate or illustrated the participants' absence of knowledge related to the item to be written.* Retrospective verbal reports like "I don't know how to spell this word" were put into this category;
- The second category included retrospective verbal reports that revealed the presence of some well-integrated knowledge such as when the child *used automated procedures* that she or he was unable to describe clearly. Retrospective verbal reports like "I already learned it" or "I know how to write this word" were put in this category. As seen before, these types of retrospective verbal reports have often been considered as a strategy named *direct retrieving from memory* in other studies. However, if we rely on the definition of "strategy" that has been seen previously, these types of retrospective verbal reports involve the activation of a procedure, not a strategy;
- The third category concerned the *use of a strategy*.

Retrospective verbal reports that involved the *use of a strategy* were further classified into the four sub-categories that were discussed in the introduction: *phonological*, *visuo-orthographic*, *analogy* and *backup*. It is those comments that interested us the most.

All comments were recorded on audiotape and two research assistants analyzed retrospective verbal reports in order to code participants answers. The classification of the comments was highly reliable. The agreement rate was 95 %. The few disagreements were resolved through discussion.

Results

Descriptive results linked with the *Written narrative task* will be presented first. Next the performance on the *Spelling dictation task* will be described.

In order to answer the first research question, we were interested in the overall success rate in the *Spelling dictation task* and the success rates according to different word properties (complexity and length). Second, we investigated the retrospective verbal reports made by the participants for each item in order to determine their preferred strategies (second research question). Third, we conducted correlations between the correctly spelled words and the types of retrospective verbal reports made. This allowed us to answer our third research question. Finally, after establishing which spelling strategies led to more success in a dictation context, we investigated whether or not there was a correlation between participants' general spelling ability (*Written narrative task*) and the strategies that they used. This allowed us to answer the fourth research question.

Written narrative task

A grapheme analysis was performed to estimate children's general spelling ability. The mean score for the *Written narrative task* was 79 % ($SD = .06$) for DYS, 87 % ($SD = .05$) for RA and 89 % ($SD = .05$) for CA. To verify if there were significant differences between groups, an ANOVA was performed with group (DYS, RA, CA) as a between-subjects factor. The results showed a group effect, $F(2, 77) = 32.86$, $p < .001$, $\eta^2 = .46$. Tukey post hoc analysis also revealed that DYS's performance was significantly lower than RA's and CA's ($p < .001$ in both cases). The results also indicated that RA's spelling skills did not differ from those of CA's ($p = .4$).

Spelling dictation task

The first part of this section is devoted to the analysis of words produced in the dictation task. The second part will focus on the analysis of the participants' retrospective verbal reports.

Analysis of words produced in the context of dictation

The mean success rate per group on the *Spelling dictation task* was 48 % ($SD = 3.02$) for DYS, 72 % ($SD = 3.73$) for RA and 79 % ($SD = 3.59$) for CA. To determine the differences between groups, an ANOVA was conducted with group (DYS, RA, CA) as a between-subjects factor. The results indicated a group effect, $F(2, 78) = 38.26$, $p < .001$, $\eta^2 = .50$. Tukey post hoc analysis showed that DYS participants' success rates on this task was significantly lower than that of RA and CA ($p < .001$ in both cases). The post hoc analysis also indicated that RA's success rate did not differ from that of CA ($p = .23$).

Second, Fig. 1 shows the mean success rates (maximum 8 per category) according to word complexity for each group of participants.

To determine potential differences between groups, an ANOVA was conducted with group (DYS, RA, CA) as a between-subjects factor and level of complexity as a within-subjects factor (minimum, medium, maximum). Results showed a group effect, $F(2, 78) = 38.26$, $p < .001$, $\eta^2 = .50$, and a level of complexity effect, $F(2, 156) = 285.82$, $p < .001$, $\eta^2 = .79$. There was also an interaction between the group and the level of complexity, $F(4, 156) = 16.79$, $p < .001$, $\eta^2 = .30$. Based on this interaction, post hoc pairwise results will be presented after controlling for the level of complexity. Regardless of the group, items of minimal complexity were more successfully completed than items of medium complexity, which were more successfully completed than items of maximum complexity ($p < .05$ in all cases). For items of minimal complexity, DYS's scores were significantly lower than CA's scores ($p < .05$), but did not differ significantly from RA's scores ($p = .7$), and RA's scores did not differ from CA's scores ($p = 1.0$). In contrast, for items of medium and maximum complexity, DYS had significantly poorer performance than RA and CA ($p < .001$ for all four comparisons), but RA and CA did not differ one from the other ($p = .8$ for items of medium complexity and $p = .2$ for items of maximum complexity).

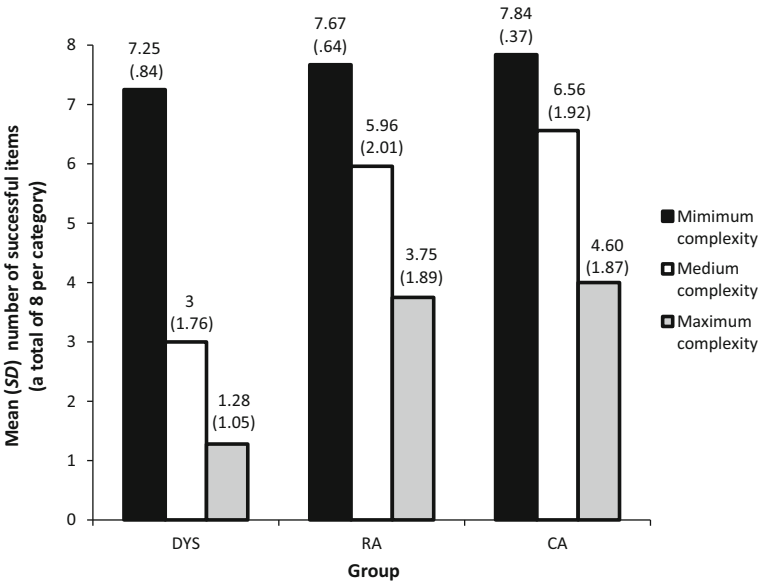

Fig. 1 Mean (*SD*) success rates (maximum 8 per category) according to word complexity for each group

Third, Fig. 2 reports the mean success rates (maximum 12 per category) according to word length for each group.

To determine the effet of word length on success rate, an ANOVA was performed with group (DYS, RA, CA) as a between-subjects factor and word length as a within-subjects factor (short, long). The results showed a group effect, $F(2, 78) = 38.26$, $p < .001$, $\eta^2 = .50$, and a word length effect, $F(1, 78) = 19.01$, $p < .001$, $\eta^2 = .20$. There was also an interaction between group and word length, F

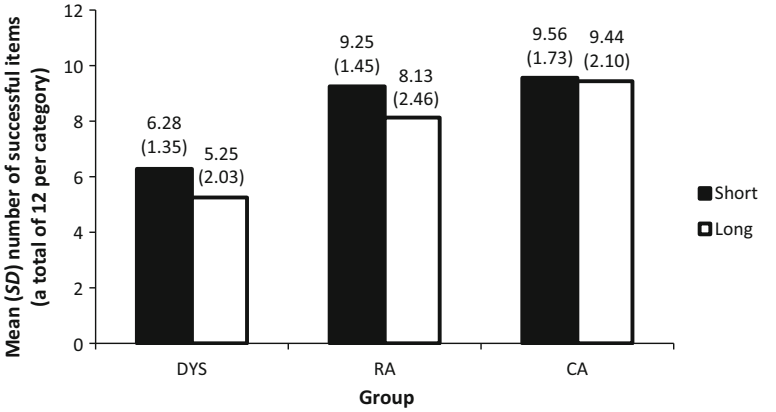

Fig. 2 Mean (*SD*) success rates (maximum 12 per category) based on the word length according to each group

$(2, 78) = 3.27$, $p < .05$, $\eta^2 = .08$. Post hoc pairwise analyses were also performed, after controlling for each variable. The results indicated that, for short words and long words, DYS had significantly lower scores than RA and CA ($p < .001$ in all cases) and that there was no significant difference between the performances of RA and CA ($p = 1.0$ for short words and $p = .12$ for long words). For DYS and RA, performance decreased significantly when word length increased ($p < .05$ in both cases). However, for CA, the length of the word did not seem to alter their performance ($p = .7$ in both cases).

Analysis of retrospective verbal reports

As mentioned previously, after participants had written each word, the experimenter asked them to explain how they had managed to spell the word. All retrospective verbal reports were classified into three broad categories as shown in Table 3. Then, retrospective verbal reports in the last major category (related to the use of a strategy) were classified according to the four types of strategies presented previously. In this table, we give the mean number of retrospective verbal reports per group for each of the categories. We considered only retrospective verbal reports made for words that were correctly spelled.

The largest number of retrospective verbal reports categorized as irrelevant, inaccurate or unknown was made by DYS, followed by CA and RA. The situation was similar regarding retrospective verbal reports that revealed the presence of specific knowledge or well integrated procedures. We can see that the majority of the retrospective verbal reports concerned the use of a strategy. Also, we can see that the most used type of strategy by all groups was the phonological one.

We were also interested in knowing if certain strategies could be linked to participants' spelling ability. With this aim, Pearson correlation analyses were performed between the spelling scores obtained in the dictation context and the types of strategies participants used. We report in Tables 4, 5 and 6 correlations by group.

In Table 4, we see that in DYS participants only analogy and backup strategies were significantly linked to success rates on the dictation task, whatever the orthographic complexity or word length.

Table 3 Mean (*SD*) number of retrospective verbal reports by group for each category

	DYS	RA	CA
Comments that are irrelevant, inaccurate or unknown (*SD*)	4.69 (3.69)	2.00 (2.59)	4.04 (4.85)
Comments that reveal the presence of specific knowledge or well integrated procedures (*SD*)	9.91 (4.36)	7.63 (4.52)	8.60 (6.49)
Comments that are related to the use of a strategy (*SD*)	17.50 (7.26)	24.67 (10.34)	23.44 (9.17)
Phonological (*SD*)	11.28 (7.09)	13.63 (7.25)	11.76 (6.72)
Visuo-orthographic (*SD*)	1.94 (3.16)	4.17 (3.57)	4.64 (5.52)
Analogy (*SD*)	2.81 (3.2)	4.92 (5.68)	5.32 (5.68)
Backup (*SD*)	1.47 (2.02)	1.96 (1.97)	1.72 (2.26)

Table 4 Correlation between dictation spelling scores and strategies used by DYS

	Comments made by DYS related to the use of			
	A phonological strategy	A visuo-orthographic strategy	An analogical strategy	A backup strategy
Items of minimal complexity	−.21	−.15	**.43***	.21
Items of medium complexity	.03	−.006	.26	**.54****
Items of maximum complexity	−.16	−.12	**.38***	.32
Short items	.03	−.03	**.36***	**.39***
Long items	−.16	−.11	**.36***	**.46****

Bold to show that they were significantly correlated

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

Table 5 Correlation between dictation spelling scores and strategies used by RA

	Comments made by RA related to the use of			
	A phonological strategy	A visuo-orthographic strategy	An analogical strategy	A backup strategy
Items of minimal complexity	.14	.29	−.08	.02
Items of medium complexity	−.20	.35	−.04	−.17
Items of maximum complexity	−.36	.37	−.07	−.14
Short items	−.26	**.44***	−.09	−.15
Long items	−.26	.39	−.06	−.15

Bold to show that they were significantly correlated

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

Table 6 Correlation between dictation spelling scores and strategies used by CA

	Comments made by CA related to the use of			
	A phonological strategy	A visuo-orthographic strategy	An analogical strategy	A backup strategy
Items of minimal complexity	−.02	.11	.06	.09
Items of medium complexity	−.10	.36	−.21	.07
Items of maximum complexity	.19	**.54****	−.35	.17
Short items	.09	**.51****	−.29	−.02
Long items	−.001	**.41***	−.24	.25

Bold to show that they were significantly correlated

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

Table 5 shows that for RA participants, only short word spelling was linked to the use of visuo-orthographic strategies. Orthographic complexity does not seem to matter in RA.

In Table 6, we see that for CA participants, only visuo-orthographic strategies were significantly correlated to correct word spelling in a dictation context. This is the case for orthographic complex words. This is also the case whatever the word length.

Links between spelling skill and retrospective verbal reports of the participants

To verify if there was a relationship between the general spelling skill of participants (results on the *Written narrative task*) and their performance in a dictation context (results on the *Spelling dictation task*), a correlation analysis was performed. For all groups, there was a strong positive correlation between the results on both tasks (DYS: $r = .54$, $n = 32$, $p < .001$; RA: $r = .75$, $n = 24$, $p < .001$; CA: $r = .81$, $n = 24$, $p < .001$). The test for equality of slopes shows that the correlation is not stronger from one group to another, correlations are of similar amplitude [$F(2, 74) = 3.04$, $p = .54$].

Because the results of the *Written narrative task* and the results of the *Spelling dictation task* were correlated, it was reasonable to think there was a link between the general spelling skill and the nature of retrospective verbal reports made by participants. To investigate this, another correlation analysis between the general spelling skill of participants and the retrospective verbal reports made by them was conducted. The results of this analysis are in Table 7.

Table 7 does not display participants' spelling ability score obtained in the dictation context but in the written production context (from the *Written narrative task*) in which participants had the opportunity to use words that they already knew.

Table 7 shows that in the typically-developing children, the general spelling skill only correlates with visuo-orthographic strategies. No correlation was observed in the group with dyslexia.

Table 7 Correlation between general spelling ability and strategies used in all three groups

	Comments made by all three groups related to the use of			
	A phonological strategy	A visuo-orthographic strategy	An analogical strategy	A backup strategy
DYS	−.15	−.10	.26	.28
RA	−.10	**.60****	.12	−.09
CA	.15	**.59****	−.15	.17

Bold to show that they were significantly correlated

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

Discussion

General performances on the *Written narrative task* and the *Spelling dictation task* will be discussed first. Following this, we will try to answer our four research questions. In both the *Written narrative task* and the *Spelling dictation task*, DYS participants success rates were significantly lower than those of RA and CA. Also, results indicated that RA's success rate did not differ from that of CA.

The fact that DYS's performance was systematically lower than CA's was not surprising. Researchers in other studies have also reached this conclusion (Manis, Custodio, & Szeszulski, 1993; Martinet & Valdois, 1999; Plisson, 2010; Snowling, Goulandris, & Defty, 1996). However, in some studies, when the performance of DYS students was compared to that of RA students, results showed that both groups were comparable (Bourassa & Treiman, 2003; Cassar, Treiman, Moats, Pollo, & Kessler, 2005; Friend & Olson, 2010; Manis et al., 1993; Martinet & Valdois, 1999; Snowling et al., 1996). Others reported that performance differed, that is to say that DYS students obtained lower scores than RA students (Coleman, Gregg, McLain, & Bellair, 2008; Friend & Olson, 2010; Hoefflin & Franck, 2005; Kemp, Parrila, & Kirby, 2009; Manis et al., 1993; Plisson, 2010; Snowling et al., 1996). Our results are consistent with these last studies. This may be explained in two different ways. The first explanation goes in the same direction as Casalis (2003), who reported that lower performance of participants with dyslexia in comparison to the two control groups could indicate an atypical developmental pattern. Unfortunately, we cannot confirm this interpretation because our study was not longitudinal and was not designed to observe such a developmental pattern. The second explanation is that the control groups were matched on reading and not on spelling. It is therefore possible to assume that the spelling performance of participants with dyslexia was lower than their reading performance. This may be explained by the fact that the French orthographic code is much more inconsistent in spelling than it is in reading (Pacton, Foulin, & Fayol, 2005), which would make the task of word production more difficult than word recognition.

An interesting result concerns the fact that RA's performance did not differ from CA's. This finding was surprising. Indeed, we would expect 12-year-old typically-developing children to spell better than 10-year-old typically-developing children. Even though this was not the purpose of this study, we noticed qualitative differences between groups at the level of syntactic structures and in terms of vocabulary. We did not analyze those differences in this study, however. But the fact that we did not observe statistical differences between groups for orthographic ability leads us to ask ourselves the following question: Do spelling skills evolve beyond the first years of schooling? Unfortunately, our data do not allow us to answer this question, especially because the control groups did not significantly differ from each other on the *Written narrative task*. Longitudinal studies could be very pertinent to answer this question. Indeed, by collecting and analyzing spelling productions over time in the same sample, we could determine with more precision which orthographic features evolve beyond first grade.

Now that the performance on the *Written narrative task* and the *Spelling dictation task* have been presented and discussed, we will try to answer our four research questions.

The objective behind the first question was to assess whether the word properties complexity and length affect word production. With regard to word complexity, for all groups, it appeared that the more complex the item was, the more difficult it was to spell it. Our results seem to fit with conclusions of other studies that investigated typically developing children's spelling skill (Alegria & Mousty, 1996; Lété et al., 2008; Pacton, Borchardt, Treiman, Lété, & Fayol 2014; Sprenger-Charolles, Siegel, Béchennec, & Serniclaes, 2003; Sprenger-Charolles et al., 1998). In those studies, regular words were spelled correctly more often than irregular words. The main difference, which explains the interaction in our results, was that orthographic complexity affected writers with dyslexia much more than it affected typically developing children. When the items were more irregular (like those in our medium and maximum complexity categories), participants needed to use other strategies than phonological strategies because the appropriate spelling could not be obtained through grapho-phonological processes. It is possible that those with dyslexia have particular difficulties in spelling irregular words that require the use of visuo-orthographic knowledge. This could be explained by the fact that those with dyslexia had greater difficulties developing stable spelling representations in spite of the number of years of experience that they had with the written language (Goswami, 2002; INSERM, 2007; Lyon et al., 2003; Plisson et al., 2013; Snowling, 2000). Thus, because they had difficulties memorizing stable grapheme sequences, they would have difficulties retrieving mental orthographic representations from their mental lexicon at the time of writing.

With regard to the length of words, our results fit once again with the conclusions of other studies where the spelling skill of typically developing children was investigated (Foulin, 1997; Lété et al., 2008), that is, shorter words were written correctly more often than longer ones. Word length seems to influence spelling performance, especially for DYS and RA. More precisely, the longer words were, the more spelling scores for DYS and RA groups decreased for these words. As these groups were weaker in writing, the short words were probably better represented mentally than long words (Foulin, 1997; Lété et al., 2008). In contrast, for more skilled spellers, word length was not a variable that could account for spelling success rate, as it did not in this study for the CA participants.

The objective behind the second research question was to observe which types of strategies francophone students adopt for word production. Using the retrospective verbal protocols collected in the *Spelling dictation task*, it had been observed that participants with dyslexia used four types of spelling strategies: a phonological strategy (based on the phoneme-grapheme correspondence), analogy (based on the use of known words to spell unknown words that share orthographic similarities), a visuo-orthographic strategy (based on visual and specific properties of words) and a backup strategy (based on a personal mnemonic device for one specific word). This result does not fit with the traditional stage models which have suggested that children's development of reading and spelling go through a series of stages or phases, which are each marked by the adoption of a particular procedure (a

graphophonological procedure or an orthographic procedure). In fact, our participants use a variety of strategies of different levels of effectiveness. This result is however consistent with the Overlapping Waves Model (Siegler, 1996) which postulates that a wide variety of strategies would be at the child's disposal to spell a word.

Among the four strategies used, we saw that the most used type of strategy by those with dyslexia (and by typically developing children) was the phonological one. This result corresponded to those of studies of typically developing children (Devonshire & Fluck, 2010; Rittle-Johnson & Siegler, 1999; Steffler et al., 1998) and students with difficulties (Farrington-Flint et al., 2008; Harrison, 2005; Sharp et al., 2008). According to these authors, the most used "strategies" are phonological strategies and retrieving processes. However, as claimed by the definition we have adopted, retrieving is considered a procedure and not a strategy because it is unclear whether students use this action consciously to solve a problem. The emphasis put on phonological strategies may be explained by the fact that children are exposed to teaching methods focusing heavily on phoneme-grapheme correspondences (Ehri et al., 2001; Jaffré & Fayol, 2013; Martinet & Valdois, 1999). But, the wide variety of strategies used shows that even if spelling instruction is mainly based on phoneme-grapheme correspondences, children are aware that recourse only to a phonological strategy is insufficient. Thus they develop a set of spelling strategies to be able to write all the words of the French language, as has been suggested in the Overlapping Waves Model (Siegler, 1996).

Also, the large number of retrospective verbal reports made by the participants showed that the methodology was adequate, even with students with dyslexia and younger students. These results are consistent with Ericsson and Simon (1993), who stated that the most effective way to describe strategies was to use verbal protocols.

With the third research question, we were interested in knowing if certain strategies are most effective in a dictation context. To do so, Pearson correlation analyses were performed between the score obtained at the *Spelling dictation task* and the types of strategies participants used.

First, results showed that, for DYS participants, only analogy and backup strategies were significantly linked to success rates on the dictation task. This result is not consistent with empirical studies concerned with spelling strategies and conducted with children who had learning difficulties (Darch et al., 2000; Farrington-Flint et al., 2008; Harrison, 2005; Sharp et al., 2008). None of them reported that analogy and backup strategies were linked to success in spelling. We assume that participants with dyslexia applied these strategies effectively because they corresponded to operations that allowed them to make connections with their prior knowledge, thus ensuring the retention of new knowledge. These operations may be less cognitively demanding and require less detailed knowledge of word properties. However, these operations are specific to each word and could not easily generate orthographic knowledge. On one hand, analogy applies to any context. In fact, regardless of the properties of the word to be spelled (whatever its complexity, length, etc.), the child can always ask the same question, namely, "What known word could help me spell ____?" On the other hand, the use of a backup strategy is very much word specific, as it is used only for certain spelling configurations

because the child has a personal mnemonic device for one particular word (for example, *toujours* always takes a /s/).

Second, results showed that, for RA participants, only success for short word spelling was linked to the use of visuo-orthographic strategies. These results are not consistent with other empirical studies. In fact, among the studies conducted with typically developing children, only Rittle-Johnson and Siegler (1999) reported that strategies such as analogy and the phonological strategy were significantly linked to success rates on a dictation task. This can be explained by the age difference between participants in both studies. In our study, children were aged 9–12 years, while those who participated in the study of Rittle-Johnson and Siegler (1999) were aged 6–8 years. The words that were included in the latter study were quite simple, because participants were younger. The production of these words was generally reflected by the use of a phonological strategy. In our research, the use of a phonological strategy could not lead to a correct production as frequently as in Rittle-Johnson and Siegler (1999) because the level of complexity of words considerably increased, and it may have affected younger writers more. Also, it is possible to note that RA often used visuo-orthographic spelling strategies just as CA did (as discussed below). The fact that participants with dyslexia did not report these strategies often enough for them to account for DYS's lower performance in dictation.

Third, for CA participants, only visuo-orthographic strategies were significantly correlated to correct word spelling in the dictation context. Once again, this result is not consistent with empirical studies concerned wtih spelling strategies with typically developing children (Devonshire & Fluck, 2010; Rittle-Johnson & Siegler, 1999; Steffler et al., 1998). As for RA, results (see Rittle-Johnson & Siegler, 1999) seemed to indicate that the phonological strategy and analogy were the most efficient strategies. This may be explained by the fact that CA were more able to store sequences of graphemes in their mental lexicon, as they had more experience with writing. To support this statement, some authors have also shown that visuo-orthographic properties were acquired by learners implicitly after sustained exposeure to literacy (Pacton, Perruchet, Fayol, & Cleeremans, 2001). The more a student reads a word, the more she or he will be able to record and process word properties, including visuo-orthographic properties of this word (Gombert, 2003). Considering that DYS and RA had less experience with writing, they would have been less likely to have stored this type of information in their mental lexicon than CA had.

Considering that results on the *Written narrative task* and that results on the *Spelling dictation task* were strongly correlated, the parallel has been made between the participants' spelling skill and the spelling strategies used to answer the fourth research question. In fact, we wanted to know if all spelling strategies are equally related to participants' spelling skills (as measured by the *Written narrative task*). Results revealed that for typically developing children (RA and CA), the visuo-orthograhic strategy was the only strategy that was related to the participants' spelling skill. For DYS, no strategy seemed related to their spelling skill as evaluated in the narrative production task. These results therefore differed somewhat from those obtained in the *Spelling dictation task*. For participants with

dyslexia, it is possible to suppose that the dictation context encouraged them to think more about their orthographic production because they had only one word to write at a time, and this led them to use strategies that were less demanding cognitively. Indeed, analogy and the backup strategy may be less demanding in terms of linguistic manipulation. However, the phonological strategy and the visuo-orthographic strategy required greater consideration of specific properties of words. The difficulty in writing for students with dyslexia likely reduced their available cognitive energy, leading them to use less demanding strategies.

Presumably, operations related to correspondence between phonemes and graphemes were more automated for typically developing children than for those with dyslexia. So, typically developing children did not have to focus on basic phonological processes and could consciously use the visual-orthographic strategy that not only produced a word that was phonologically plausible, but also a word that was orthographically plausible. It is therefore possible to hypothesize that the visual-orthographic strategy is more available when the writer has mastered enough of the phonological procedures of writing. These procedures would be relatively integrated at the end of the second year of schooling (Giguère, Giasson, & Simard, 2010), which corresponds to the age of our RA participants. Obviously, our results did not allow us to test this hypothesis, but it would be worth validating it in future empirical work. In fact, a longitudinal study would be very interesting for exploring this assumption. By analyzing retrospective verbal reports about the spelling strategies that children used to produce a word at different moments in time, we could determine with more precision when strategies become more integrated.

Here, it is important to remember, that although phonological strategies were the most used type of strategies, they were not related to spelling skill in this study. Even if phonological strategies are essential in the development of young writers' spelling skills, it seems that visuo-orthographic strategies are the best indicators of success in spelling. Unfortunately, very little is yet known about how visual properties of words are acquired and even less about how they are taught. This is also an interesting avenue of research.

Conclusion

The main purpose of this study was to investigate the spelling ability of children with dyslexia by taking into account the spelling strategies participants reported using. The results showed that phonological strategies were the most used, but that they were not correlated to success in spelling. This has direct implications for teaching practices. It is certainly a good thing to work on phonology with students with dyslexia. However, it is not sufficient for the development of good spelling skills. We need to consider teaching other strategies that will enable students to spell words better. On one hand, no strategy was related to DYS's spelling skill. On the other hand, visuo-orthographic strategies appeared to lead more successfully to correct spellings in both groups of typically-developing children (RA and CA). Since the performance of these participants may be used to define the expectations of possible strategies to use, it is important to note the role of visuo-orthographic

knowledge in learning lexical spelling. However, the importance of visuo-orthographic strategies observed in this study may also be language specific. Indeed, French has one of the most inconsistent alphabetic systems (Seymour et al., 2003). It is very possible that languages with opaque orthographic systems like English or French favor the use of visuo-orthographic strategies, while more regular languages may mainly solicit phonological strategies.

Considering that we do not know at present how visuo-orthographic knowledge is taught (and if it is taught), it would be relevant to conduct work on this question. For example, it would also be interesting to consider the creation of a training program to promote the acquisition of visual properties of words by students in a longitudinal or cross-sectional perspective or to compare the use of visuo-orthographic strategies by students of different ages.

Acknowledgments This study was supported by a grant from FQRSC (Grant #136836) to the second author.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent Informed consent was obtained from all individual participants included in the study.

Appendix: 24 dictated words of the *Spelling dictation task*

	Length	
	Short words	Long words
Minimal complexity	*maman*	*aviron*
	ami	*animal*
	lire	*petite*
	robe	*salade*
Medium complexity	*saumon*	*contente*
	vilain	*agenda*
	pomme	*arrive*
	quinze	*quatorze*
Maximum complexity	*habit*	*haricot*
	oignon	*examen*
	femme	*seconde*
	chlore	*orchestre*

References

Alegria, J., & Mousty, P. (1996). The development of spelling procedures in French-speaking, normal and reading-disabled children: Effects of frequency and lexicality. *Journal of Experimental Child Psychology, 63*(2), 312–338. doi:10.1006/jecp.1996.0052.

Besse, J.-M. (2000). *Regarde comme j'écris: écrits d'élèves, regards d'enseignants*. Paris: Magnard.

Bosse, M. L., & Pacton, S. (2007). *Comment l'enfant produit-il l'orthographe des mots?* Retrieved from http://webu2.upmf-grenoble.fr/LPNC/resources/marie_line_bosse/2007-ChapitreBosse%26Pacton.pdf.

Boulc'h, L., Gaux, C., & Boujon, C. (2007). Implication des fonctions exécutives dans le décodage en lecture: Étude comparative entre normo lecteurs et faibles lecteurs de CE2. *Psychologie Française, 52*, 71–87. doi:10.1016/j.psfr.2006.11.001.

Bourassa, D., & Treiman, R. (2003). Spelling in children with dyslexia: Analyses from the Treiman–Bourassa early spelling test. *Scientific Studies of Reading, 7*(4), 309–333. doi:10.1207/s1532799xssr0704_1.

Carrillo, M. S., Alegría, J., & Marín, J. (2012). On the acquisition of some basic word spelling mechanisms in a deep (French) and a shallow (Spanish) system. *Reading and Writing, 26*(6), 799–819. doi:10.1007/s11145-012-9391-6.

Casalis, S. (2003). The delay-type in developmental dyslexia: Reading processes. *Current Psychology Letters, 10*, 2–7.

Cassar, M., Treiman, R., Moats, L., Pollo, T. C., & Kessler, B. (2005). How do the spellings of children with dyslexia compare with those of nondyslexic children? *Reading and Writing, 18*(1), 27–49. doi:10.1007/s11145-004-2345-x.

Cauchon, J., Jutras, L., & Létourneau, G. (2001). *Tous azimuts: Français, 1er cycle du primaire*. Boucherville: Graficor.

Coleman, C., Gregg, N., McLain, L., & Bellair, L. W. (2008). A comparison of spelling performance across young adults with and without dyslexia. *Assessment for Effective Intervention, 34*(2), 94–105. doi:10.1177/1534508408318808.

Conseil supérieur de l'éducation – CSE. (2008). *Plan stratégique 2007–2011*. Québec: Gouvernement du Québec.

Daigle, D., & Montésinos-Gelet, I. (2013). Le code orthographique du français: ses caractéristiques et son utilisation. In D. Daigle, I. Montésinos-Gelet, & A. Plisson (Eds.), *Orthographe et populations exceptionnelles* (pp. 11–34). Montréal: Presses de l'Université du Québec.

Darch, C., Kim, S., Johnson, S., & James, H. (2000). The strategic spelling skills of students with learning disabilities: The results of two studies. *Journal of Instructional Psychology, 27*, 15–27.

Devonshire, V., & Fluck, M. (2010). Spelling development: Fine-tuning strategy-use and capitalising on the connections between words. *Learning and Instruction, 20*(5), 361–371. doi:10.1016/j.learninstruc.2009.02.025.

Écalle, J. (1998). L'acquisition de l'orthographe lexicale. *Glossa, 62*, 28–35. Retrieve from http://blog.ove.asso.fr/orthos_surdite/files/2010/06/ecalle98.pdf.

Ehri, L. C. (1999). Phases of development in learning to read words. In J. Oakhill & R. Beard (Eds.), *Reading development and the teaching of reading: A psychological perspective* (pp. 79–108). Oxford: Blackwell Science.

Ehri, L. C. (2005). Learning to read words: Theory, findings, and issues. *Scientific Studies of Reading, 9*(2), 167–188. doi:10.1207/s1532799xssr0902_4.

Ehri, L. C., Nunes, S. R., Willows, D. M., Schuster, B. V., Yaghoub-Zadeh, Z., & Shanahan, T. (2001). Phonemic awareness instruction helps children learn to read: Evidence from the National Reading Panel's meta-analysis. *Reading Research Quarterly, 36*(3), 250–287.

Ericsson, K. A., & Simon, H. A. (1993). *Protocol analysis: Verbal reports as data*. Cambridge: MIT Press.

Farrington-Flint, L., Stash, A., & Stiller, J. (2008). Monitoring variability and change in children's spelling strategies. *Educational Psychology, 28*(2), 133–149. doi:10.1080/01443410701471850.

Fayol, M., & Jaffré, J.-P. (2008). *Orthographier* (1st ed.). Paris: Presses Universitaires de France.

Foulin, J. N. (1997). Bons et faibles orthographieurs. In S. Guillard (Ed.), *Lecture et dyslexies* (pp. 181–196). Grenoble: Les Pluriels de Psyché.

Friend, A., & Olson, R. K. (2010). Phonological spelling and reading deficits in children with spelling disabilities. *Scientific Studies of Reading, 12*(1), 90–105. doi:10.1080/10888430701773876.

Frith, U. (1985). Beneath the surface of developmental dyslexia. In K. Patterson, J. C. Marshall, & M. Coltheart (Eds.), *Surface dyslexia: Neuropsychological and cognitive studies of phonological reading* (pp. 301–330). London: Lawrence Erlbaum Associates.

Frith, U. (1986). A developmental framework for development dyslexia. *Annals of Dyslexia, 36*, 69–81. doi:10.1007/BF02648022.

Gaouette, D., & Renaud, B. (2000). *En tête: Français, 1er cycle du primaire*. Saint-Laurent: Éditions du Renouveau pédagogique.

Giguère, J., Giasson, J., & Simard, C. (2010). Les relations entre la lecture et l'écriture: Représentations d'élèves de différents niveaux scolaires et de différents niveaux d'habileté. *Revue Canadienne de Linguistique Appliquée, 5*, 23–50.

Gombert, J.-E. (2003). L'apprentissage des codes grapho-phonologique et graphosémantique en lecture. In M. N. Romdhane, J. É. Gombert, & M. Belajouza (Eds.), *L'apprentissage de la lecture: Perspectives comparatives* (pp. 19–34). Rennes: P.U.R.

Goswami, U. (2002). Phonology, reading development, and dyslexia: A cross-linguistic perspective. *Annals of Dyslexia, 52*(1), 139–163. doi:10.1007/s11881-002-0010-0.

Graham, S., Harris, K. R., & Chorzempa, B. F. (2002). Contribution of spelling instruction to the spelling, writing, and reading of poor spellers. *Journal of Educational Psychology, 94*(4), 669–686. doi:10.1037//0022-0663.94.4.669.

Harrison, G. L. (2005). The spelling strategies of students with varying graphophonemic skills: Implications to instruction and intervention. *Exceptionality Education Canada, 15*(3), 57–76.

Hoefflin, G., & Franck, J. (2005). Development of spelling skills in children with and without learning disabilities. *L1-Educational Studies in Language and Literature, 5*(2), 175–192. doi:10.1007/s10674-005-0917-6.

Institut national de la santé et de la recherche médicale - INSERM. (2007). *Dyslexie, dysorthographie, dyscalculie: Bilan des données scientifiques*. Paris: Institut national de la santé et de la recherche médicale.

Jaffré, J. P., & Fayol, M. (2013). Orthography and literacy in French. In R. M. Joshi & P. G. Aaron (Eds.), *Handbook of orthography and literacy* (pp. 81–104). New York: Routledge.

Kaufman, A. S., & Kaufman, N. L. (1993). *K-ABC: Batterie pour l'examen psychologique de l'enfant*. Paris: Édition du centre de psychologie appliquée.

Kemp, N., Parrila, R. K., & Kirby, J. R. (2009). Phonological and orthographic spelling in high-functioning adult dyslexics. *Dyslexia, 15*(2), 105–128. doi:10.1002/dys.364.

Lachapelle, M.-L., & Péladeau, I. (1999). *Lexibul: Français, 1er cycle du primaire*. Mont-Royal: Modulo.

Legendre, R. (2005). *Dictionnaire actuel de l'éducation*. Montreal: Guérin.

Lété, B., Peereman, R., & Fayol, M. (2008). Consistency and word-frequency effects on spelling among first- to fifth-grade French children: A regression-based study. *Journal of Memory and Language, 58* (4), 952–977. doi:10.1016/j.jml.2008.01.001.

Lété, B., Sprenger-Charolles, L., & Colé, P. (2004). MANULEX: A grade-level lexical database from French elementary school readers. *Behavior Research Methods, Instruments, & Computers, 36*(1), 156–166. doi:10.3758/bf03195560.

Lin, J. (2013). *The effects of code-based literacy interventions on spelling achievement: A meta-analysis*. New York: University of New York.

Lyon, G. R., Shaywitz, S., & Shaywitz, B. (2003). A definition of dyslexia. *Annals of Dyslexia, 53*(1), 1–14. doi:10.1007/s11881-003-0001-9.

Manis, F. R., Custodio, R., & Szeszulski, P. A. (1993). Development of phonological and orthographic skill: A 2-year longitudinal study of dyslexic children. *Journal of Experimental Child Psychology, 56* (1), 64–86. doi:10.1006/jecp.1993.1026.

Martinet, C., & Valdois, S. (1999). L'apprentissage de l'orthographe d'usage et ses troubles dans la dyslexie développementale de surface. *L'Année Psychologique, 99*, 577–622.

Pacton, S., Borchardt, G., Treiman, R., Lété, B., & Fayol, M. (2014). Learning to spell from reading: General knowledge about spelling patterns influences memory for specific words. *The Quarterly Journal of Experimental Psychology, 67*(5), 1019–1036. doi:10.1080/17470218.2013.846392.

Pacton, S., Foulin, J.-N., & Fayol, M. (2005). *L'apprentissage de l'orthographe lexical*. Retrieve from http://www.orthoedition.com/medias/fichiers/2011-01-10-09-47-55_1918731.pdf#page=46.

Pacton, S., Perruchet, P., Fayol, M., & Cleeremans, A. (2001). Implicit learning out of the lab: The case of orthographic regularities. *Journal of Experimental Psychology, 130*, 401–426. doi:10.1037/0096-3445.130.3.401.

Parent, J., & Morin, M.-F. (2005). Observer les stratégies de l'apprenti lecteur/scripteur pour mieux l'accompagner. *Québec Français, 138*, 58–60.
Plisson, A. (2010). *La compétence orthographique d'élèves dyslexiques du primaire*. Montréal: Université de Montréal.
Plisson, A., Daigle, D., & Montésinos-Gelet, I. (2013). The spelling skills of French-speaking dyslexic children. *Dyslexia, 19*(2), 76–91. doi:10.1002/dys.1454.
Raven, J.-C. (1998). *Manual for Raven's progressive matrices and vocabulary scales*. Antonio: Harcourt Assessment.
Raynal, F., & Rieunier, A. (2005). *Pédagogie: Dictionnaire des concepts clés. Apprentissage, formation, psychologie cognitive*. Issy-les-Moulineaux: ESF Éditeur.
Rittle-Johnson, B., & Siegler, R. S. (1999). Learning to spell: Variability, choice, and change in children's strategy use. *Child Development, 70*(2), 332–348. doi:10.1111/1467-8624.00025.
Sénéchal, M. (2000). Morphological effects in children's spelling of French words. *Canadian Journal of Experimental Psychology, 54*(2), 76.
Sénéchal, M., Basque, M. T., & Leclaire, T. (2006). Morphological knowledge as revealed in children's spelling accuracy and reports of spelling strategies. *Journal of Experimental Child Psychology, 95*(4), 231–254.
Seymour, P. H. K., Aro, M., & Erskine, J. M. (2003). Foundation literacy acquisition in European orthographies. *British Journal of Psychology, 94*, 143–174.
Sharp, A. C., Sinatra, G. M., & Reynolds, R. E. (2008). The development of children's orthographic knowledge: A microgenetic perspective. *Reading Research Quarterly, 43*(3), 206–226. doi:10.2307/20068342.
Siegler, R. S. (1996). *Emerging minds: The process of change in children's thinking*. New York: Oxford University Press.
Snowling, M. J. (1994). Towards a model of spelling acquisition: The development of some component skills. In G. D. A. Brown & N. C. Ellis (Eds.), *Handbook of spelling: Theory, process and intervention* (pp. 111–128). Chichester: Wiley.
Snowling, M. J. (2000). *Dyslexia*. Oxford: Blackwell.
Snowling, M. J., Goulandris, N., & Defty, N. (1996). A longitudinal study of reading development in dyslexic children. *Journal of Educational Psychology, 88*(4), 653–669. doi:10.1037/0022-0663.88.4.653.
Sprenger-Charolles, L., & Colé, P. (2003). *Lecture et dyslexie: approche cognitive*. Paris: Dunod.
Sprenger-Charolles, L., Siegel, L. S., Béchennec, D., & Serniclaes, W. (2003). Development of phonological and orthographic processing in reading aloud, in silent reading, and in spelling: A four-year longitudinal study. *Journal of Educational Psychology, 84*(3), 194–217.
Sprenger-Charolles, L., Siegel, L., & Bonnet, P. (1998). Phonological mediation and orthographic factors in reading and spelling. *Journal of Educational Psychology, 68*, 134–155.
Steffler, D. J., Varnhagen, C. K., Friesen, C. K., & Treiman, R. (1998). There's more to children's spelling than the errors they make: Strategic and automatic processes for one-syllable words. *Journal of Educational Psychology, 90*(3), 492–505. doi:10.1037/0022-0663.90.3.492.
Tardif, J. (1992). *Pour un enseignement stratégique: L'apport de la psychologie cognitive*. Montreal: Logiques.
Treiman, R. (1993). *Beginning to spell: A study of first-grade children*. New York: Oxford University Press.
Treiman, R., & Bourassa, D. C. (2000). The development of spelling skill. *Topics in Language Disorders, 20*(3), 1–18.
Varnhagen, C. K., McCallum, M., & Burstow, M. (1997). Is children's spelling naturally stage-like? *Reading and writing: An interdisciplinary journal, 9*, 451–481.