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Improving students' punctuation: classroom experimentation and results in texts by primary and secondary school students in Quebec

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Abstract: The texts of primary and secondary school students show a high proportion of written errors related to punctuation (Boivin and Pinsonneault, 2018, among others). Yet punctuation instruction often offers students only limited opportunities to improve their control of sign usage in a writing context (Riverin and Dufour, 2018). This article presents a quasi-experimental study involving 16 French classes from cycle 3 of primary school and cycle 1 of secondary school in Quebec (age 10 to 13). Students in the experimental groups carried out a sequence of 20 activities implementing three innovative didactic devices, designed during a first phase of the research, in collaboration with the participating teachers. The aim was to improve punctuation and syntax in writing. We will present results drawn from the analysis of short texts written at pre-test and post-test (two texts at each time: one descriptive and one narrative) in the experimental and control groups, in relation to success variables in segmentation into graphic sentences (capital letter & full stop), and

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in punctuation within graphic sentences and syntactic sentences (clauses, i.e. subject + predicate (+ sentence adverbial(s)), for some comma usage rules.

Key words: punctuation, syntax, quasi-experimental study, writing competence, primary and secondary school students.

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Introduction and Research Problem

Punctuation has long been seen as an effective and economical means of constructing the meaning of a text, which "[...] enables many problems in written communication to be solved at the lowest possible cost" (Bessonnat, 1991, p. 10, free translation). Judicious use of punctuation marks in French requires mastery of a number of rules. According to Tanguay (2006), for example, a comma is required in front of the conjunctions *mais* (but) and *car* (because), which coordinate two syntactic sentences (e.g., *Alex is feverish, but he's going out for a run anyway.*), but not in front of the conjunction *et* (and) (e.g., *Alex is feverish and he's going out for a run anyway!*). However, most of the rules are syntactically based and require the ability to analyze the sentence, in particular by delimiting and combining sentences. For example, it is important to master the delimitation of the syntactic sentence in order to apply the rule that two juxtaposed syntactic sentences (or "placed side by side in the graphic sentence" [Lefrançois, 2020, p. 288, free translation]) must be separated by a comma, semicolon or colon (e.g., *Alex is feverish, he's going out for a run anyway.*).

What about students' mastery of punctuation marks in writing? Studies documenting the frequency of punctuation errors among primary and secondary school students have shown that these errors are among the most numerous in their texts in comparison with errors of other types (e.g., agreement errors, homophone errors, etc.), at different grade levels (Boivin & Pinsonneault, 2018; Gouvernement du Québec, 2015). In the study by Boivin and Pinsonneault (2018) in particular, errors in the punctuation subcategory were found to be the most frequent per 100 words, compared with other syntax errors or grammatical spelling errors, among students (n = 969) at four school levels (primary 4 and 6, secondary 2 and 5).

Studies documenting verbalizations about punctuation have long shown a tendency for primary and secondary school students to base their decisions primarily on criteria that are not syntactic, but related to prosody and meaning (Richer, 1994; Lemaitre, 1999). Even in more recent studies, researchers have come to the following conclusion about the use of commas: "For [students], the comma is mainly perceived as marking a pause (to 'catch one's breath', 'take a breath' or 'mark a stop') or it plays an essentially separative role (to 'separate one idea from another')" (Paolacci *et al*., 2016, p. 228, free translation). Yet prosodic and semantic criteria are vague and subjective (Giguère *et al*., submitted). What's more, in the collaborative context of text revision, students rarely discuss punctuation effectively, and when they do, the syntactic aspect seems neglected and poorly mastered (Blain & Lafontaine, 2010; Colognesi & Deschepper, 2014).

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In terms of teaching practices, several researchers report that punctuation is not taught in a very systematic way in French class, either in Quebec (e.g., Dufour, 2017) or in France (Bain, 1999; Paolacci & Garcia-Debanc, 2003; Jaffré, 2014; Paolacci & Rossi, 2014). This could be linked to a certain conception of punctuation as an exercise in style, or even an "art" (Grevisse, 1969; Tanguay, 2006). For example, by giving prominence to the stylistic role of the comma, "arguably the most stylistic of punctuation marks" according to Riegel *et al*. (2016, p. 151, free translation), some teachers might neglect to teach the use of this mark based on the syntactic structure of the sentence, leaving its use to the discretion and aesthetic judgment of the student. According to Riverin and Dufour (2018), when punctuation is taught, it is generally done deductively, i.e., through the presentation of a rule followed by exercises targeting this rule, an approach that could be described as reductive and limiting. These exercises are most often based on decontextualized sentences for which the analysis of syntactic construction is not solicited, like in certain workbooks (Bain, 1995; Nadeau & Fisher, 2011). According to Bessonnat (1991), in the teaching of punctuation, it is important to "break down the feeling of arbitrariness and randomness that might prevail in the use of punctuation marks" (p. 12, free translation), and to put forward teaching that shows that marks "form a system" (*ibid*.) according to a logic based on clearly defined and operational criteria.

Carried out with primary-age students (aged 7 to 11), the studies reviewed with classroom intervention on punctuation converge on the finding that devices focusing on the development of metalinguistic awareness lead to significant positive effects on students' ability to punctuate their texts correctly (Jarno-El Hilali, 2012, 2014; Colognesi & Deschepper, 2014). Following Jarno-El Hilali (2012, 2014), the syntactic approach, in contrast to the prosodic criteria often invoked (e.g., Richer, 1994; Lemaitre, 1999), provides a solid foundation for students' metalinguistic reflection and leads them to informed sign choices (Bessonnat, 1991; Nadeau *et al*., 2020a). These foundations could also be put to good use with secondary school students, who also encounter difficulties with punctuation (Boivin & Pinsonneault, 2018; Gouvernement du Québec, 2015).

The study reported in this paper[1] was carried out in two phases:

1. Design and develop didactic devices in the field of syntax and punctuation, then articulate them in a sequence of activities for the cycle 3 of primary school and

1 [Nadeau, Giguère & Fisher, Programme Actions concertées, FRQ-SC-MEES, 2016-2020)

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another for cycle 1 of secondary school, in "at-risk" (disadvantaged) environments[2];

2. Test the two sequences and measure their effects in students' narrative and descriptive texts along two dimensions: *sentence construction* and *punctuation*.

The aim of this article is to present the results of phase 2 of the study for the punctuation dimension, the results for the syntax dimension being presented in another contribution (Quevillon Lacasse *et al*., submitted).

Conceptual Framework

The conceptual framework first presents some indicators of the development of punctuation marking in writing in a school context, then the key theoretical foundations for teaching grammar - of which punctuation is a part - that promotes the mobilization of grammatical knowledge, including the rules for using punctuation marks in writing.

Indicators of progress in punctuation

A recent systematic review of the scientific literature (Arseneau, 2020) looked at the mastery of punctuation in writing in classes with French as language of schooling with students aged 6 to 17 from a developmental perspective. By analysing the results of the 15 empirical studies selected, the author identified three stages in the development of punctuation, as shown in Table 1.

2 See the Methodology section for details about the three didactic devices that make up the sequence and the term "disadvantaged environment".

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Table 1.

Three developmental stages of punctuation (Arseneau, 2020)

Stage	Age	Characteristics
Stage 1	6 to 9 years old	• Dominating use, and often erroneous, of the capital letter and full stop • Connectors are used instead of commas to join syntactic sentences (these connectors include coordinating conjunctions as well as some adverbs: *and*, *and then*, *then*, *after*, *so*, etc.
Stage 2	10 to 13 years old	• More adequate segmentation of graphic sentences • Increase in the frequency of comma use
Stage 3	13 to 17 years old and adults	• Better organization of text into paragraphs • Comma use within syntactic sentences still needs improvement

In Stage 1 (6 to 9 years old), students make a fairly rudimentary use of punctuation marks, illustrated by the progressively more successful use of capital letters and periods (e.g. Chanquoy & Fayol, 1995). Students at that stage often omit to mark the junction of syntactic sentences (clauses - SyntS) (**There was a rolled-up rug next to the wall the rug was all orange*) or prefer the use of connectors (*and, so, then, and then*) to that of the comma, which sometimes leads to "over-coordination", a well-known phenomenon (Hunt, 1970). This overuse of semantically uninformative connectors, which often punctuate oral discourse, is a particularly frequent phenomenon among novice writers (Béguelin, 2000; see also Boré [ed.], 2016), which illustrates the transfer of oral characteristics (e.g. intonation, solidarization of statements) into writing.

In Stage 2 (10 to 13 years old), students segment their text into graphic sentences (GraphS) more confidently, and make more frequent use of commas, especially when juxtaposing SyntS. The absence of a juxtaposition sign between two SyntS remains the most frequent error recorded by Chenu and Ailhaud (2016), but its frequency decreases significantly between 10-11-year-old students and those in the two older groups (12-13 and 14-15 years old). This developmental stage corresponds to a turning point in students' use of the comma (Favart & Passerault, 2000).

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Stage 3 (ages 13 to 17) is first identified by an increase in the segmentation of text into paragraphs (Favart & Passerault, 2009). The results of a Government of Quebec study (2013) with 13- and 14-year-old students also indicate a certain mastery of the use of the period (GraphS segmentation) and the comma between SyntS (juxtaposition), but difficulties persist in the use of commas to separate phrases within the SyntS.

The developmental stages outlined here are based on descriptive empirical studies documenting the production of punctuation marks in writing according to different text types and genres, which sheds light on the errors to be targeted in studies with didactic intervention.

Theoretical foundations for grammar teaching

As the French punctuation system is linked to grammatical notions, the theoretical foundations for effective grammar teaching may also be relevant for the teaching of punctuation. We present below the foundations that guided the design of innovative devices for improving syntax and punctuation as part of this study.

The development of writing competence and writing skills, including the mastery of punctuation marks, relies on the learning of explicit grammatical knowledge and procedures that are exercised consciously and reflectively (Jaffré, 1995; Nadeau & Fisher, 2006; Brissaud & Cogis, 2011), thus developing students' metalinguistic awareness. Indeed, repeated exposure to correct grammatical forms, syntactic structures and punctuation marks alone can produce implicit knowledge but it is not sufficient to ensure deliberate and judicious use of this knowledge in writing (Nadeau & Fisher, 2011).

Given the importance of students' metalinguistic awareness in learning to write (Gombert, 2006; Ribas *et al*., 2014), it is important to rely on didactic devices that promote metalinguistic activity, i.e., "an activity of awareness and analysis of language phenomena, which enables their study or control in a production situation" (Delcambre, 2010, p. 127, free translation). These devices allow for student verbalizations and verbal interactions between students and with the teacher (Cogis & Ros, 2003; Cogis *et al*., 2016; Arseneau *et al*., 2018). It is during these verbalizations and interactions that grammatical knowledge and procedures are refined, adjusted, and consolidated "[...] so as to become 'internalized' and then available in individual situations" (Arseneau & Lefrançois, 2019, p. 55, free translation).

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These verbalizations and interactions are even more fruitful if they are based on the use of grammatical metalanguage (Fisher & Nadeau, 2014; Huneault, 2013). Defined as "the repertoire of specialized terms for talking about language, for example [...] 'verb' [and] 'adjective' " (Delcambre, 2010, p. 127, free translation), metalanguage is closely linked to the development of metalinguistic awareness (Gombert, 1990) and serves as a foundation for the construction of explicit grammatical knowledge by supporting the conceptualization process (Barth, 2004; Lord & Elalouf, 2016). Adopting the concepts of "syntactic sentence" and "graphic sentence", for example, would reduce the polysemy surrounding the term "sentence", which, used in a broad sense, can be understood as a syntactic, graphic, semantic, or even enunciative unit (Benveniste, 1966), and thus create confusion.

The theoretical foundations invoked here follow a socioconstructivist perspective that places great emphasis on dialogue and interaction between peers (Vygotski, 1934/2013; Swain, 2010; Brissaud & Cogis, 2011). Moreover, the teacher's scaffolding of students' verbalizations and consideration of transitory conceptions supports students' appropriation of transferable reasoning in the production and revision of their own texts (Nadeau & Fisher, 2014; Tobola Couchepin *et al*., 2017; Ammar & Hassan, 2017).

It should be noted that these foundations are also at the basis of metacognitive and interactive dictation, a device developed to teach French silent grammatical spelling which has been proven effective to improve grammatical spelling in texts written by students in different school contexts (Nadeau & Fisher, 2014; Nadeau *et al*., 2020b; Ammar & Hassan, 2017; Wilkinson, 2009).

Methodology

Participants

The experiment was carried out in primary and secondary school classes in three regions of Quebec (Montreal, Montreal South Shore, Lac-St-Jean). The schools from which the classes were drawn were all considered "underprivileged", i.e., with a socio-economic index (SEI) of decile 8, 9 or 10 at the time the participants were recruited. According to a study by Desrosiers and Tétreault (2012; n = 1040), students from the least advantaged quintile perform much less on the primary 6 writing test than those from the other four quintiles (66% vs. 95% for the most advantaged quintile), results that call for intervention with students from disadvantaged backgrounds.

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Table 2 shows the sample of participants and texts analyzed[3]. Each student wrote two texts (one descriptive and one narrative), at pre-test and at post-test (e.g., 59 primary cycle 3 students each wrote two descriptive texts, for a total of 118 texts analyzed), so that comparisons could be made using the same sample of students for the same type of text.

Table 2.

Participants and texts analyzed

Groups	Number of schools	Number of teachers	Number of classes	Number of participating students in the analyzed sample		Number of texts analyzed (Pre-test and post-test)	
				Descriptive text	Narrative text	Descriptive text	Narrative text
Primary – Cycle 3 – Experimental	4	5	4	59	64	118	128
Primary – Cycle 3 – Control	3	4	4	51	53	102	106
Secondary – Cycle 1 – Experimental	4	4	6	93	91	186	182
Secondary – Cycle 1 – Control	2	2	2	29	29	58	58

Course of the study

The study was carried out in two phases, as outlined above. Phase 1 involved the design, development, and pre-experimentation of didactic devices for the teaching of syntax and punctuation, in close collaboration with teachers. This first phase took place according to an action-research design (Savoie-Zajc, 2001), following a spiral progression made up of

[3] Ethical certification for the study was obtained from the *Comité institutionnel d'éthique de la recherche avec les êtres humains* (CIEREH) of *Université du Québec à Montréal* (UQAM). All participating teachers, parents and teacher consultants provided informed consent to their participation and to the use of the data collected for research purposes.

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iterative cycles of *planning*, *action*, *observation*, and *reflection* (Dolbec & Clément, 2000; Morrissette, 2013). The activities designed by the researchers (*planning*) in line with the theoretical foundations (*cf.* conceptual framework) were presented to the teachers and modeled during collective meetings, then experimented within the classroom (*action*) in the presence or absence of the researchers (*observation*). During the meeting following a series of classroom trials, teachers and researchers would discuss (*reflection*) the usability, usefulness, and acceptability of the activities (Goigoux, 2017; Renaud, 2020), clarify the course for each activity and make adjustments, then relaunch the cycles. At the end of phase 1, the three devices and a sequence of 20 activities for each cycle level (Nadeau *et al*., 2020a) were finalized. The teachers were then ready to implement them in phase 2, given the experience gained in phase 1 and the support received in a professional development perspective (*cf.* Giguère *et al*., 2018).

Phase 2, was devoted to a quasi-experimental research design (Fortin & Gagnon, 2022), i.e., involving a comparison of the effects of at least two different conditions (experimental, control). In education, this type of research, known as quasi-experimental (vs. experimental), means that the experimentation took place in natural, intact classrooms, with no selection of students using various individual criteria. Students in the experimental and control groups were subjected to a pre-test at the start of the school year (October 2017) and a post-test at the end of the school year (May 2018) in the form of writing tasks involving two types of text. Between these two times, teachers and students in the experimental classes carried out the syntax-punctuation intervention, i.e., a sequence of 20 activities adapted to their cycle level. Group meetings were held with the participating teachers to monitor the experiment and ensure optimal implementation of the sequence. During the same period, the control classes followed a "regular teaching of French" documented by means of two individual telephone interviews following a semi-directed interview protocol (Laroui & de la Garde, 2017).

Described in detail in other contributions (Nadeau *et al*., 2020a, 2020c) and summarized in the table in Appendix 1, the experimental sequence uses three devices[4]. The first device aims to establish a common metalanguage for talking about syntax and punctuation, by introducing the notions of "syntactic sentence" (SyntS) and "graphic sentence" (GraphS;

[4] The experimental sequence and videos of these classroom practices are available on the Facebook group *Dictée 0 faute, phrase du jour, combinaison de phrases et plus...* (https://www.facebook.com/groups/852304104823499; administrator, M. Nadeau)

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Nadeau *et al*., 2020a). By manipulating SyntS constituents on colored cards (Subject, Predicate and Sentence Adverbial), conjunctions and punctuation marks, students, through observation and questions from the teacher, realize that "a GraphS can be made up of one or more SyntS joined by a conjunction or a punctuation mark". Thus, 3 to 4 periods are needed at the start of the didactic sequence, in preparation for carrying out the activities from devices 2 and 3, where the concepts and associated metalanguage are reinvested (*cf.* Appendix 2).

In line with metacognitive and interactive dictations (Nadeau & Fisher, 2014), the activities in device 2 are designed to prompt discussions that build students' grammatical knowledge and procedures relating to sentence construction, on the one hand, and develop their metalinguistic awareness to support punctuation choices, on the other. Thus, in a negotiated punctuation activity, "in the style of metacognitive dictation", the teacher invites students to add punctuation marks to a short unpunctuated text, and then to take part in discussions in which all punctuation marks proposed by the students are justified using the concepts of SyntS and GraphS in particular. Each activity of this type of device lasts between 35 and 40 minutes and was carried out 6 to 7 times during the school year in each participating class in the experimental group.

The activities stemming from device 3 aim to "[provide] direct, mindful practice in manipulating and rewriting basic or kernel sentences into more syntactically mature or varied forms" (Saddler, 2005, p. 468). Adapted from the "sentence combining" activity (Saddler, 2019; Saddler *et al*., 2008), which has shown significant positive effects on writing skills (Graham & Perin, 2007), the sentence combining activity proposes that students construct, from four or five short, simple SyntS, a single GraphS containing all the information from the series of given SyntS. After the individual combining step, and the teacher's choice of one or two combined sentences for whole-group analysis, a teacher-guided metalinguistic discussion allows the students to name the processes that were used to combine the SyntS into a single GraphS, be they coordination, subordination, adding complements to a noun phrase ("densification of the noun phrase"), or other processes (Nadeau *et al*., 2020c). This activity lasts between 35 and 40 minutes and was carried out around ten times during the school year in each class from the experimental group. The 20 activities of 30 to 40 minutes each that make up the sequence were spread out from October to early May, i.e., an average of three activities per month, replacing a grammar lesson, which was acceptable to the teachers.

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Instruments and data analysis

The study included two data collection instruments. The pre-test took place in late September/early October, and the post-test in May, in the experimental and control groups.

With no prior work on textual genre or text type, the participating students completed two writing tasks at pre-test and post-test using images from a children's literature book (Van Allsburg, 1984 / 2014); one task aimed at producing a descriptive text and the other, a narrative text. These two textual types are the source of a significant number of textual genres studied in primary and early secondary school (Chartrand *et al*., 2015). The instructions for writing the descriptive text were "Describe in detail what you see in the picture so that someone can imagine it well without seeing it." For the narrative text, the general instructions were adapted to each image: "The author has created mystery around this image by adding the sentence [sentence taken from the album]. It's up to you to imagine this story, inspired by the image, the title and the sentence." To avoid a potential image effect in the results, half the students wrote their two texts from image A at pre-test and the other half from image B. At post-test, the images were crossed according to an AB-BA pattern, i.e., students who had written from image A at pre-test did so from image B at post-test, and vice versa. Each task lasted around 60 minutes, with a week's interval between the descriptive text and the narrative text. Only the texts produced by students with complete data for one type of text (pre-test and post-test) were retained for analysis, and the vast majority of students produced all four texts (see Table 2).

Texts were digitized and then coded using QDA Miner software (version 5, Provalis, 2018). Ten percent of texts were cross-coded for punctuation indicators, with results indicating an inter-rater agreement (between different raters for the same text) of 89,35% and an intra-rater agreement (between texts recoded by the same rater) of 94%. Table 4 shows the text coding grid for punctuation indicators. Note that the sentences provided as examples often contain more errors than the one underlined to illustrate the code used.

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Table 4.

Coding grid

	Code	Examples from student texts[5]
GraphS delimitation	GraphS – correct delimitation	*Ça commence dans les années 132 avant JC dans un petit village tranquille et paisible.* (capital letter at the beginning, and strong punctuation mark at the end)
	GraphS – delimitation error	*Je suivais les sentiers comme d'habitude puis tout à coup. Je suis tombé sur un ruisseau* (erroneous mark, misplaced or unnecessary) *Je suis tombé sur un ruisseau se ruisseau n'étais pas là avant.* (correct ending punctuation mark but incorrect delimitation at the beginning) *Il avanse doucement doucement et il marche sur le bord de la rivière, et il manque tomber a l'eau.* (overcoordination: two "and" conjunctions, where one could be replaced with a full stop) […] *trois petit poisson bleu saut tout près de la harpe il y avait des arbres des gros rochers la harpe est sur un rocher.* (absent punctuation marks)
SyntS delimitation using juxtaposition (comma or other punctuation mark)	SyntS – correct juxtaposition	*Il y a un ruisseau qui sépare cette jungle en deux, quelques petites, très petites chutes peuvent être aperçues entre les petites roches qui occupent le ruisseau.*
	SyntS – erroneous juxtaposition	*Pour finir, il y a une petite porte, elle est faite en bois* […], *elle est trop petite pour qu'un humain ne puisse passer à travers.* (overuse of juxtaposition) *Je me rappelle l'époque où tout était si beau où le ridicule ne tuait pas*. (absent punctuation mark to juxtapose subordinate SyntS/clauses)
Use of a comma to separate a word or phrase appearing in front of the Subject	Correct use of comma	*À droite, de l'autre côté, une harpe se tient là, toute seule.* (2 occurrences)
	Erroneous use of comma or absence of comma	*Lorsque, j'ai vu mon frère je lui ai souri.* (erroneous use of comma) *Aujourd'hui je vais vous raconter mon aventure dans la forêt des fées.* (absence of comma)

[5] For examples of full texts produced by the participating students, see Nadeau *et al*. (2020c).

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Each well-used punctuation mark relating to GraphS delimitation, juxtaposed SyntS delimitation or the detachment of a word or phrase before the subject (sentence adverbial, textual connector, etc.) was marked with a specific code, as were erroneous uses or absent marks relating to the same phenomena. This made it possible to calculate individual success rates of a punctuation mark in each text.

Statistical analyses were carried out on the basis of these individual text rates by UQAM's Data Analysis Consulting Service. Parametric tests (repeated-measures ANOVA) and non-parametric tests (Wilcoxon signed ranks for comparison by time factor; Mann-Whitney for intergroup comparison) were performed according to indicators of normality (or abnormality) of the distribution (skewness, kurtosis).

Results

An important result to note first is that, according to the tests performed, the experimental and control groups are equivalent at pre-test (no significant difference; Mann-Whitney test) for all variables and grade levels, except in one case reported in Figure 6.

The convention of using asterisks to present statistical significance levels is used in the figures (*: $p \leq 0{,}05$; **: $p \leq 0{,}01$; ***: $p \leq 0{,}001$).

Punctuation of Graphic Sentences (GraphS)

Figure 1 shows the average rates of correct GraphS punctuation on all expected GraphS in descriptive and narrative texts among primary Cycle 3 students.

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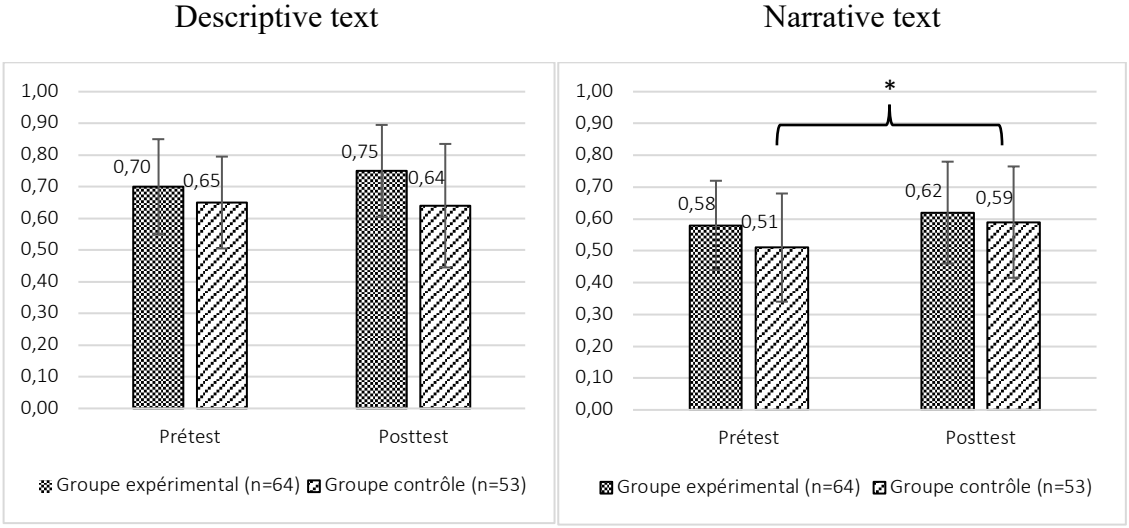
Figure 1.

Average rates of correct GraphS punctuation in the descriptive and narrative texts in Cycle 3 of primary school



The tests carried out for the comparison between the two times (Wilcoxon signed ranks) show no significant effect of time for this variable, neither in the experimental group nor in the control group for the descriptive text.

For the narrative text, the comparison between the two times (Wilcoxon signed ranks) shows no significant effect of time in the experimental group, but an improvement (*) appears in the control group ($W = 321{,}5$, $p = 0{,}043$).

Figure 2 shows the average rates of correct GraphS punctuation for each type of text produced by the participating Secondary 1 students.

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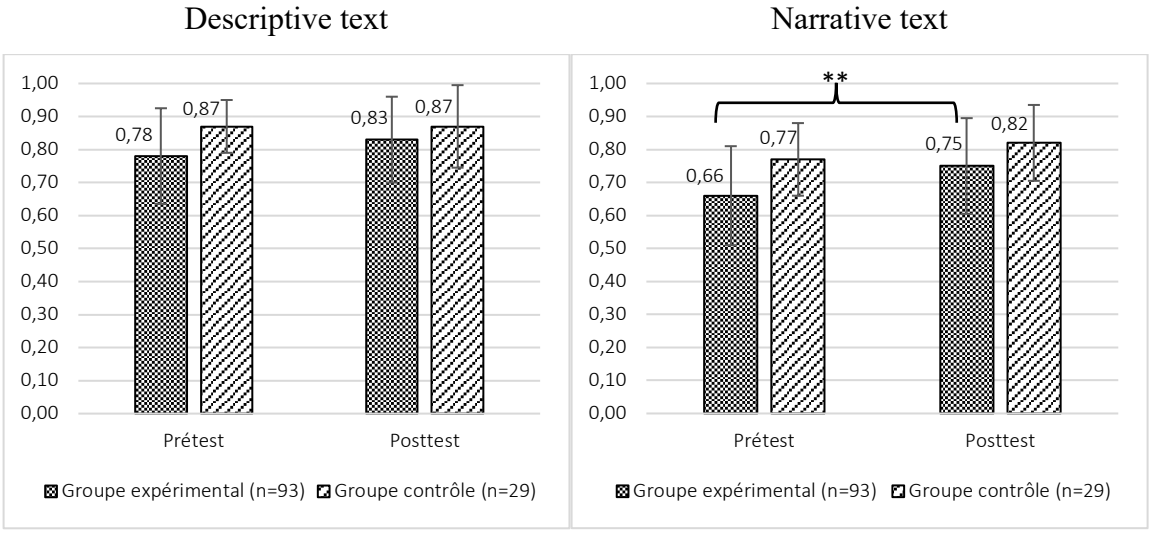
Figure 2.

Average rates of correct GraphS punctuation in the descriptive and narrative texts in Secondary 1



In the descriptive text, Wilcoxon signed rank tests for comparison between the two times show no significant effect, either for the group variable or for the time variable. In the narrative text, Wilcoxon signed rank tests show a significant effect (**) of time in the experimental group (W = 969,0, p = 0,003), whose rate of correct punctuation improves, but no significant effect in the control group.

Juxtaposition of Syntactic Sentences (SyntS)

This subsection looks at results for another indicator of punctuation mastery in writing: correct juxtaposition of SyntS, calculated out of the number of expected GraphS in each text. Figure 3 shows the results for cycle 3 of primary school in the descriptive and narrative texts.

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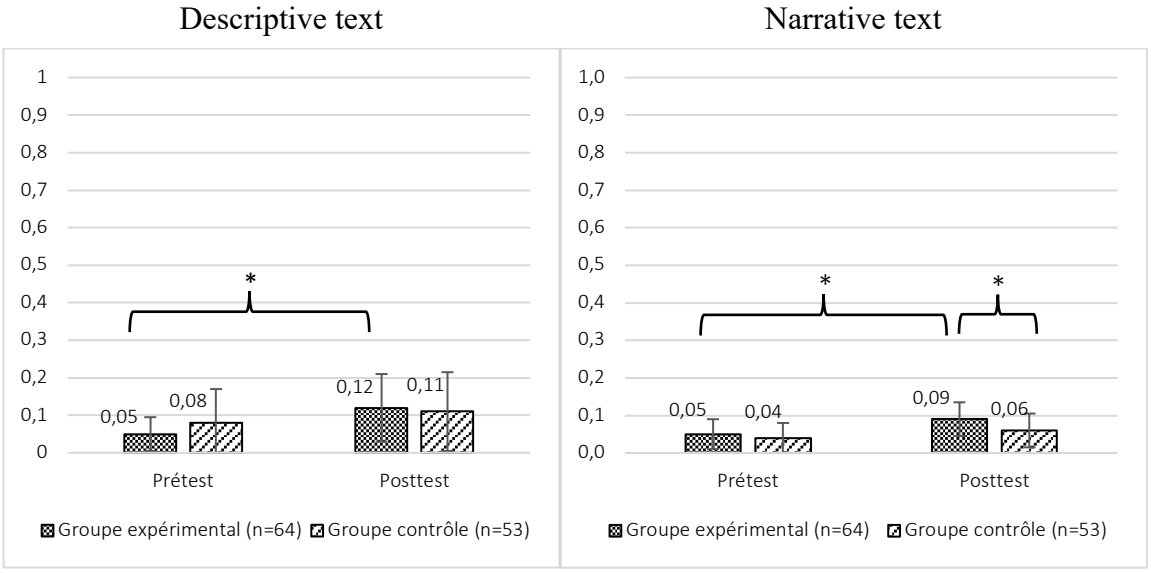
Figure 3.

Average rates of correct juxtaposition of SyntS in the descriptive and narrative texts in Cycle 3 of primary school



For the descriptive text, Wilcoxon signed rank tests show a significant effect (*) of time in the experimental group (W = 152,0, p = 0,037), where the sucess rate rises from 5% to 12%, but no significant effect in the control group. The situation is the same for the narrative text, with significant progress in the experimental group only (W = 282,0, p = 0,003). What's more, at post-test, the experimental group achieved a significantly higher success rate than the control group (W = 2110,0, p = 0,016).

Figure 4 shows the results for secondary classes.

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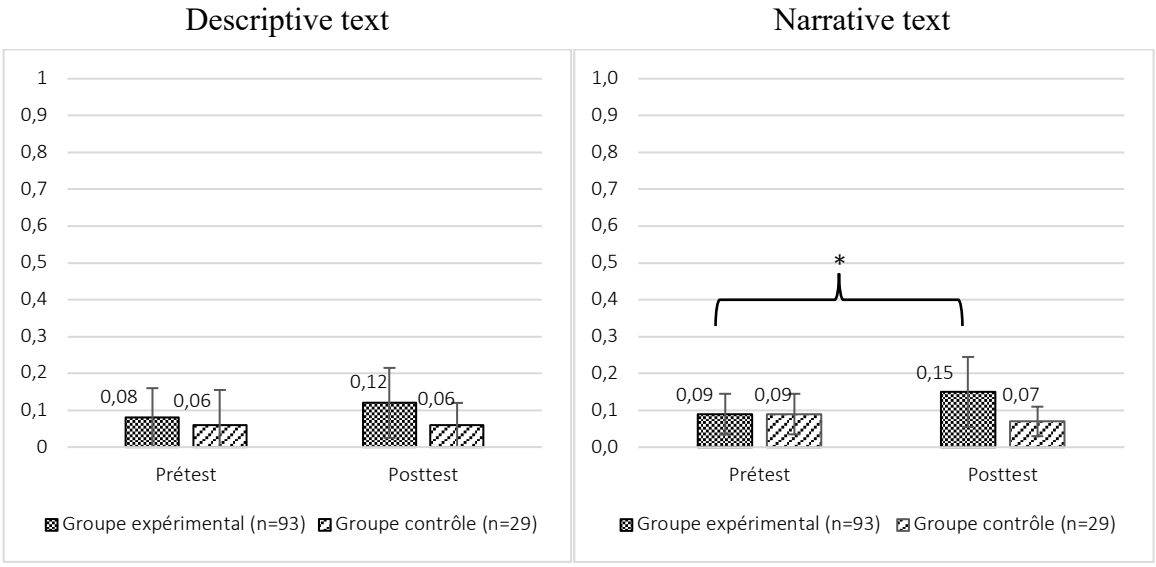
Figure 4.

Average rates of correct juxtaposition of SyntS in the descriptive and narrative texts in Secondary 1



The results of the Wilcoxon test show an effect in the descriptive text that approaches the threshold of positive statistical significance in the experimental group (W = 558,0, p = 0,051), and no significant effect in the control group.

In the narrative text, the increase in success rates between pre-test and post-test is significant in the experimental group (W = 718,5, p = 0,021), but not in the control group.

Comma to separate a phrase before the Subject

The last indicator of punctuation mastery, shown in Figures 5 and 6, is the average rate of commas used to separate a phrase or a word (Sentence Adverbial or textual connector) before the Subject, calculated on the total number phrases or words placed before the Subject used in the text. Figure 5 shows these results for Cycle 3 of primary school.

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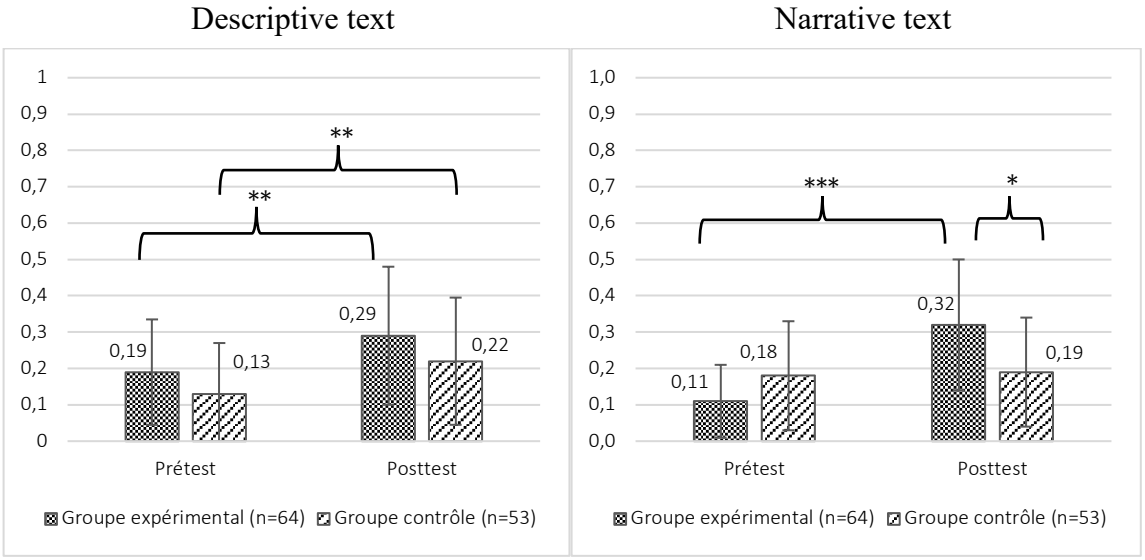
Figure 5.

Average rates of correct use of a comma to separate phrases appearing before the Subject in the descriptive and narrative texts in Cycle 3 of primary school



In the descriptive text, the effect of time on this variable is positive and significant in both groups, experimental (W = 69,0, p = 0,004) and control (W = 12,0, p = 0,002).

In the narrative text, the average rates of correct commas used to separate phrases appearing before the Subject by primary Cycle 3 students increase significantly and noticeably in the experimental group (W = 74,5, $p \leq$ 0,000), while they remain stable in the control group (n. s.). Furthermore, at post-test, the experimental group achieved a significantly higher success rate than the control group (W = 1889,0, p = 0,037).

Figure 6 shows the results for this variable in texts written in Secondary 1.

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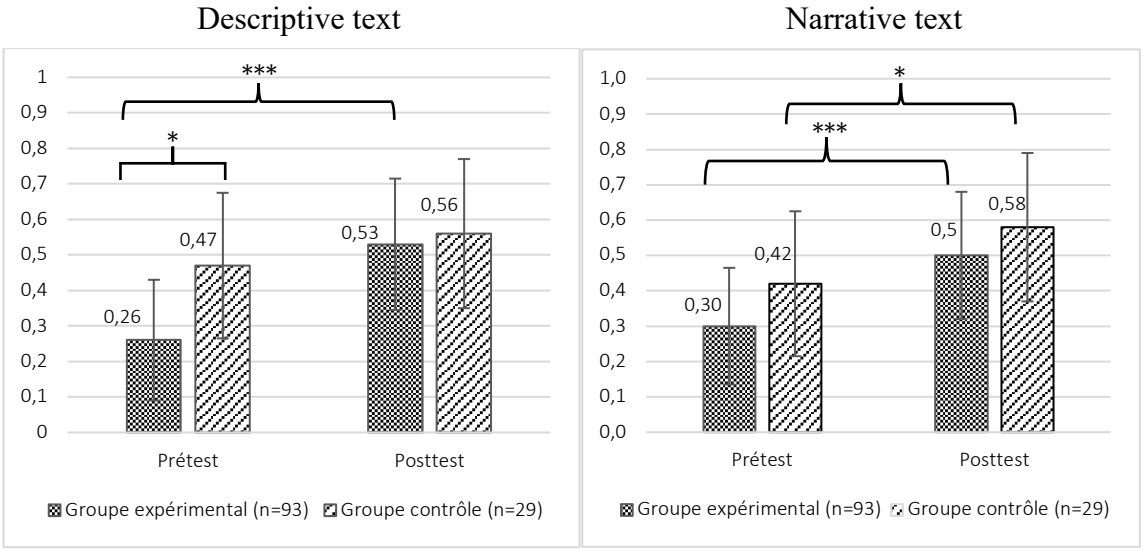
Figure 6.

Average rates of correct use of a comma to separate phrases appearing before the Subject in the descriptive and narrative texts in Secondary 1



For the descriptive text, Wilcoxon signed rank tests conducted on the distributions show a positive and significant effect of time in the experimental group ($W = 228{,}5$, $p \leq 0{,}000$), but not in the control group. For the first time, the group effect is also significant at pre-test ($U = 824{,}5$, $p = 0{,}016$), the success rate being significantly higher in the control group than in the experimental group, but it is no longer the case at post-test.

For the narrative text, Wilcoxon signed rank tests performed on the distributions also reveal a positive and significant effect of time in the experimental group ($W = 411{,}0$, $p \leq 0{,}000$), as well as in the control group ($W = 18{,}0$, $p = 0{,}010$).

Results summary

Table 5 (below) summarizes the results presented above. The “Progress” indication corresponds to a significant increase from pre-test to post-test; the indication (+) corresponds to cases where the result of the experimental group is significantly higher than that of the control group at post-test. A non-significant increase (N.s. increase) indicates an increase in the success rate from pre-test to post-test, which shows some improvement, but

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that is not statistically significant. We also report a non-significant decrease (N.s. decrease) or stability for pre-test and post-test success rates.

Table 5.

Results summary for the three variables that were examined, according to the grade level (Cycle 3 of primary school or Secondary 1), the group (experimental or control), and tthe text type (descriptive or narrative)

Variable and text type		Primary Cycle 3		Secondary 1	
		Experim. group	Control group	Experim. group	Control group
Correct GraphS punctuation / Number of GraphS	Descriptive	N.s. increase	Stability	N.s. increase	Stability
	Narrative	N.s. increase	**Progress**	**Progress**	N.s. increase
Correct juxtaposition (comma) of SyntS / Number of GraphS	Descriptive	**Progress**	N.s. increase	N.s. increase	Stability
	Narrative	**Progress (+)**	N.s. increase	**Progress**	N.s. decrease
Correct use of commas to separate phrases or words before the Subject / total number of phrases or words before the Subject	Descriptive	**Progress**	**Progress**	**Progress**	N.s. increase
	Narrative	**Progress (+)**	Stability	**Progress**	**Progress**

Table 5 shows that for three variables tested in two types of texts at two grade levels (12 tests in the experimental group and 12 in the control group), the experimental group showed significant progress in eight out of 12 variables, while the control group made significant progress in only three out of 12 variables. In the experimental group, however, when the statistical tests did not prove significant, an increase in success rates was noted, which was less often the case in the control group, where stability and a decrease were also observed.

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Discussion

In the previous section, results were presented for two types of text, descriptive and narrative, according to three indicators of punctuation mastery: correct delimitation of GraphS (capital-period or other suitable strong punctuation), successful juxtaposition of SyntS within a GraphS, and successful separation using a comma of a phrase or a word before the Subject in a SyntS.

Overall, the intervention had a positive effect, enabling students in the experimental group to make greater progress in mastering written punctuation than those in the control group (*cf.* table 5). The latter also showed some progress, which is normal, but only for a few indicators.

Regarding the correct punctuation of GraphS, it is the variable that shows the most mixed results. Moreover, no significant differences were observed in the descriptive text, either in the experimental or control groups. The two significant increases observed in the narrative text (control group, primary Cycle 3; experimental group, secondary Cycle 1) indicate no clear trend.

These results may not necessarily point to a "ceiling effect", but they can be explained by the relatively high success rates at pre-test, particularly in the descriptive text (figs. 1 and 2). Moreover, these results are consistent with those of other researchers who identify capitalization and the GraphS period as among the first punctuation marks mastered by students (Chanquoy & Fayol, 1995; Rossi-Gensane & Paolacci, 2016). This knowledge is also among the first learnings about punctuation to appear in Quebec curricula (primary Grades 1 and 2; Gouvernement du Québec, 2009). As GraphS delineation is consolidated at the end of Stage 1 (6 to 9 years old) identified by Arseneau (2020), there is reason to wonder whether this learning was in the proximal zone of development for the majority of students. According to Béguelin (2000, p. 266, free translation): "Underpunctuation thus appears either as an indication of very strong dependence on the oral mode of production, or as a deliberate imitation of oral communication in writing." With writing being introduced earlier in primary school (more formally in Grade 1 in Quebec), and the metalinguistic development that this entails (Gombert, 1990), students have gradually come to distance themselves more effectively from oral communication, replacing connectors and better segmenting statements into GraphS. This would explain their already high, albeit still perfectible, mastery of this marker at pre-test.

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Moreover, while some of the sequence's activities helped consolidate knowledge of GraphS delimitation (device 2, negotiated punctuation "in the style of..."; *cf.* Appendix 1), others, such as the sentence-combining activities (device 3), targeted SyntS junction processes more directly, such as subordination and juxtaposition. Thus, the experimental sequence would have led to more work on the internal signs of the graphic sentence than on strong punctuation during the sentence-combining activities (device 3) carried out towards the end of the sequence. This would explain why the upward trend in the success rate of GraphS punctuation is only seen once by a significant progress in the Secondary 1 students' narrative texts of the experimental group.

The second indicator of progress related to punctuation as measured in the study, i.e., the rate of correct SyntS juxtaposition (fig. 3 and 4), shows that students in the experimental groups made more progress than those in the control groups: statistical analyses reveal significant increases in success rates, for both types of text in primary school and in the narrative text in Secondary 1. These results point to the effectiveness of the teacher's intervention in working with the concept of SyntS in relation with juxtaposition. We believe that, among the three devices in the sequence, the sentence-combining activities would have focused more specifically on exploring juxtaposition as a means of joining two SyntS with a high degree of binding within a GraphS.

Also, following mental model theory (Chanquoy, 1989; Fayol, Carré & Simon-Thibult, 2014), it could be that the "metacognitive dictation-style" grammatical discussions during the negotiated punctuation activities (device 2) enabled the students in the experimental group to co-construct a more accurate mental representation of the text's units and the degree of linkage that unites them, transposing into a more judicious use of SyntS juxtaposition. According to Fayol, Carré and Simon-Thibult (2014, p. 32, free translation), "[by] the mere fact of their insertion in the same text, two states or events are necessarily linked; only the intensity of this link varies. (...) Hence the need for a system of marks capable of specifying the nature and modulating the degree of the link between adjacent statements, and thus ensuring the marking of the segmentation and continuity of transcribed information."

Moreover, the focus on juxtaposition in some of the activities of the experimented sequence can be seen as an appropriate timing between the knowledge and the stage of punctuation development reached by the students in this study (stage 2, 10 to 13 years old, Arseneau, 2020). Indeed, at this age, students tend to better join their SyntS by abandoning the use of

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connectors modeled on the spoken word and adding "boundaries" between SyntS using juxtaposition (Béguelin, 2000; Rossi-Gensane & Paolacci, 2016).

As for the third indicator of progress, the results (Figs. 5 and 6) show a significant increase in comma use to separate a phrase or a word placed before the Subject in the experimental group at primary and secondary levels in both types of text. The control group also improved significantly, but less systematically (at primary level in the descriptive text; at secondary level in the narrative text). Separating a phrase appearing before the Subject with a comma, usually a Sentence Adverbial, relies on knowledge of the syntactic functions of sentence constituents (Subject - Predicate – Sentence Adverbial), and the use of syntactic manipulations to identify them. This syntactic approach to the sentence was put forward right from the start with the manipulation of constituents on colored cards, then institutionalized by means of SyntS and GraphS definitions, relevant syntactic manipulations and an analysis approach structured in four steps (*cf.* Appendix 2).

Subsequently, during the activities of the other two devices, the analysis approach was reinvested to identify the constituents and justify SyntS boundaries. Syntactic manipulations are now recognized as powerful tools for analyzing sentences and correcting errors (Nadeau & Fisher, 2006; Chartrand, 2013; Boivin & Pinsonneault, 2019). Combined with the use of precise metalanguage, these manipulations would support the conceptualization (Fisher & Nadeau, 2014; Lord & Elalouf, 2016) of the notion of SyntS and "control" (Gombert, 1990; Delcambre, 2010) in the use of punctuation marks to indicate the displacement of a constituent, where appropriate. Thus, it could be that this systematic work on SyntS constituents based on the use of syntactic manipulations accelerated entry into the stage corresponding to this learning of punctuation (13 to 17 years old, Arseneau, 2020) among the students in the experimental group.

Building on a series of descriptive studies on the use of punctuation by school-age children (*ibid*.), the study presented here represents a first exploration of innovative ways of working on both syntax and punctuation, i.e., segmentation and connection phenomena, based on common didactic principles. Nevertheless, the research has certain limitations that future analyses or research could help to overcome. Firstly, while the three devices that make up the experimented sequence appear to be complementary and interdependent, the research design does not allow us to assess the extent to which one device would produce different or greater effects than another. A quasi-experimental study isolating and comparing the devices would allow this. Secondly, several of the correct punctuation rates presented (section 4) are lower in narrative texts than in descriptive texts. This could

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suggest an effect of text type, possibly attributable to the "runaway effect" documented for narrative texts, i.e., the tendency of students "carried along by the dynamics of their narrative" to neglect sentence segmentation as they progress through the text (Béguelin, 2000, p. 264, free translation). Hence, the text type variable could be incorporated into statistical models to shed new light on what are currently mixed results in the literature (Chanquoy & Fayol, 1995; Favart & Chanquoy, 2007; Garcia-Debanc, 2010). Finally, it would also be potentially judicious to include a measure of metalinguistic awareness and degree of "cognitive clarity" (Fijalkow, 2014) around the grammatical notions invoked, for example by means of metagraphic interviews or verbal protocols at pre-test and post-test (Roussel, 2017; Arseneau & Lefrançois, 2019).

In conclusion, the devices developed and experimented in this study offer promising avenues for the teaching of punctuation. They demonstrate the value of a syntactic approach based on a clear, operational, and circumscribed metalanguage, on the one hand, and on a systematic analytical approach integrating syntactic manipulations, on the other. Furthermore, to improve students' punctuation skills and prepare them to make a better use of punctuation in their own written productions, it is not enough to present students with lists of punctuation marks and their typical uses, nor is it enough to teach them grammar rules to be applied later in decontextualized workbooks. Empirical studies (Nadeau & Fisher, 2014; Jarno-El Hilali, 2012, 2014) confirm the need to work with authentic sentences and texts, relying on clear syntactic notions (SyntS, GraphS) and reliable tools to delineate, separate or join them. On the other hand, we need to focus on metalinguistic discussion in class, peer interaction and the verbalization of reasoning by students so as to develop students' metalinguistic awareness, which is necessary for mastering writing (Swain, 2010; Brissaud & Cogis, 2011; Tobola Couchepin *et al*., 2017; Ammar & Hassan, 2017).

In view of the challenges involved in teaching and learning punctuation, we feel it is important to pursue the line of research involving classroom experimentation, with the aim of refining our knowledge concerning practices and their effects in relation to the different variables at play (optimal number of activities for each device, duration, progression, content addressed, etc.). In this way, teachers wishing to renew their practices will be able to make informed decisions.

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Appendices

Appendix 1.

Three devices to teach syntax and punctuation in the experimented didactic sequence

1. Defining and differenciating Syntactic Sentence (SyntS) and Graphic Sentence (GraphS) concepts through the manipulation of constituents on cardboard strips *(3 to 4 30- to 45-minute class periods)*

1. **Brainstorming on the concept of sentence**

Discuss the concept of sentence by confronting definitions that are inadequate and agree with students on the need for common criteria.

2. **Let's build sentences and define the notion of sentence**

Construction of two different sentences using just two cardboard strips; observations on the two mandatory constituents (Subject + Predicate) and manipulations to identify them.

3. **Let's add some context and summarize the notion of Syntactic Sentence (SyntS)**

Addition of a green cardboard strip to one of the sentences constructed; observations on the Sentence Adverbial (manipulations, possible positions with precise metalanguage, punctuation associated with its displacement).

4. **From Syntactic Sentence (SyntS) to Graphic Sentence (GraphS)**

Two SyntS are to be combined in a single "sentence" (GraphS); identification of some processes that combine several SyntS in a single GraphS.

5. **Let's summarize the concept of sentence**

SyntS = S + Pred (+ SAdv); GraphP = one SyntS or two or more SyntS connected with a comma or a conjunction (relative pronouns to be dealt with later)

2. Negotiated punctuation *in the style of* the "dictated sentence of the day" device, with discussion and justification of all suggested punctuation marks *(6 or 7 activities, 35-40 min. each)*

1. **Formulating hypotheses**: Students punctuate a given text without punctuation or capital letters.
2. **Pooling hypotheses**: All punctuation marks are displayed on the board (including missing [ø] marks).
3. **Grammatical discussion for graphic sentence endings:** Students justify punctuation, by identifying…
   - the constituents of the SyntS by means of manipulations;
   - the process that links 2 SyntS in the case of a GraphS containing several SyntS.
4. **Grammatical discussion of comma cases…**
   - naming the rule that applies in each case;
   - justifying, where relevant, constituent functions and manipulations.
5. **End of the activity with the "To remember" section:** The teacher, with the help of the students, identifies a case of punctuation deemed interesting, which the students record in their notebooks.

3. Sentence combining, with rephrasing and identification of combining processes, and reinvestment of punctuation use *(10 activities, 35-40 min. each)*

1. **Individual combinations:** Students combine all given short SyntS in two different ways.
2. **Selection of sentences for feedback (outside class):** The teacher selects two correct combined sentences to be analyzed with the whole group and combined sentence to be corrected.
3. **Grammatical discussion:**
   - The teacher guides the students in identifying the syntactic processes used to combine the original short SyntS in the two selected combined sentences (on the smart board).
   - The teacher asks students to justify the punctuation in each combined sentence.
4. **Correction of an erroneous combined sentence (optional).** The teacher guides the students in identifying the construction problem in the selected combined sentence and in correcting it.
5. **End of the activity with the "To remember" section:** The teacher, with the help of the students, identifies a sentence-combining process deemed interesting, which the students record in their notebooks.

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Appendix 2.

Metalanguage adopted in the learning activities of the experimented sequence

Metalanguage term	Definition
Graphic Sentence (GraphS)	A sentence starting with a capital letter and ending with a full stop (or another strong punctuation mark).
Syntactic Sentence (SyntS)	A sentence composed of a Subject and a Predicate to which can be added one or more Sentence Adverbials. A Syntactic Sentence does not necessarily correspond to the basic sentence model (it can be negative, passive, interrogative, etc.).
Juxtaposition	Combining process used to link two phrases of the same function, or two Syntactic Sentences, using a punctuation mark (usually a comma).
Coordination	Combining process used to link two phrases of the same function, or two Syntactic Sentences, using a coordinating conjunction.
Subordination	Combining process used to link two Syntactic Sentences (SyntS) using a subordinating conjunction or a relative pronoun, where one SyntS plays a function in relation with the other SyntS.
Sentence Adverbial position	A Sentence Adverbial may be displaced in front of the Subject, between the Subject and the Predicate, within the Predicate or stay in its traditional position, i.e., following the Predicate. Displacements are signalled using one or two commas.
5-Step Syntactic Analysis	1- Identify the conjugated verb(s) in the GraphS; 2- Identify the Subject of each SyntS; 3- Identify the Sentence Adverbial(s) of each SyntS; 4- Identify the Predicate of each SyntS; 5- Identify the combining process(es) used to link the different SyntS in the GraphS (when applicable).