The co-regulation of writing activities in the classroom

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Abstract: After an overview of several directions of research on cognitive and social processes in writing, this article presents a model of "co-regulation" of writing activities in the classroom. Co-regulation is defined in a situated perspective as the joint influence on student writing of sources of contextual regulation (structure of the teaching/learning situation, teacher interventions and interactions with students, peer interactions, tools and artifacts) and of processes of self-regulation. This conception is illustrated by the results of research on a writing activity in 5th and 6th grade classrooms. The research concerns two aspects of the co-regulation of students' writing: (1) the role of whole-class discussions in the emergence of taken-as-shared meaning regarding the writing task and the influence of these discussions on the revisions subsequently carried out by students; (2) the articulations between self-regulation (reflected in revisions students carry out individually on their own drafts) and regulations resulting from peer interaction (reflected in revisions made during dyadic interaction). The conclusions drawn from this research are discussed with respect to their implications for writing instruction.

Keywords: co-regulation, learning to write, revision, situated learning, writing instruction

1. Toward a model of co-regulation of writing activities in the classroom

One of the major challenges for writing research is to understand the interplay between cognitive and social processes in writing activities carried out in various settings. After an overview of different directions of research on these processes, I will introduce the concept of co-regulation in a situated learning perspective on writing in the classroom. The references presented here are those that I believe are particularly important for conceptualizing the co-regulation of writing activities in elementary and secondary school. They provide guideposts for curriculum development and teaching but do not resolve all the complex issues linked to writing instruction.

1.1 Cognitive and social processes in writing

Research on cognitive and social processes in writing has had a substantial impact on the conception of classroom activities aimed at developing students' ability to produce coherent, well-structured texts. Four directions of research have been particularly influential.

The first is the research on cognitive processes involved in writing. It includes studies based on the now classical writing process models and their enlargement to include other aspects of individual psychological functioning such as affect and motivation (Hayes, 1996; Hayes & Flower, 1980). The research on cognitive processes has also examined individual difference factors (e.g., translating fluency) in the development of writing proficiency (McCutchen, Covill, Hoyne, & Mildes, 1994), as well as processes of self-regulation in writing and their enhancement by procedural facilitation (Bereiter & Scardamalia, 1987). This body of research has provided theoretical foundations for a large number of studies of writing instruction. Among the most prominent are the studies based on the Self-regulated Strategy Development (SRSD) model aimed at teaching cognitive strategies of self-regulation in writing (Graham, 2006; Harris & Graham, 1996), including the use of tools of procedural facilitation focussed on specific aspects of the writing process (De La Paz, Swanson, & Graham, 1998).

A second direction of research focuses on *sociocognitive factors* that influence the processes of text production. These factors include "reader-based" feedback (Elbow, 1981) from mentors or peers and techniques for enhancing the writer's audience awareness (e.g., "reading like the reader," Holliway & McCutchen, 2004). Studies of sociocognitive factors in classroom writing activities have examined the role of teacher-student conferences (Fitzgerald & Stamm, 1990) and of student interactions in the context of collaborative revision (Boscolo & Ascorti, 2004) or reciprocal revision (MacArthur, Schwartz, & Graham, 1991). In addition, it has been shown that the observation of other students' work can have a significant impact on the acquisition of writing skills (Rijlaarsdam et al., 2008).

In the research on sociocognitive aspects of learning to write, the focus remains largely on the writer's cognitive processing and skill acquisition, while the social dimensions (feedback, interaction, observation) are treated as distinct independent or intervening variables that influence cognition. Although many researchers – notably Schunk and Zimmerman (2007) – acknowledge reciprocal influences between cognitive and social dimensions at a theoretical level, the design of their studies and the discussion of findings emphasize a unidirectional effect of social factors (e.g., teacher modeling, peer feedback) on individual cognitive aspects of student writing (e.g., self-regulation strategies used in revising, self-efficacy beliefs).

The third and fourth directions of research to be discussed here introduce another perspective, namely one that postulates the co-constitution of cognitive and social processes during the course of writing activities. The third direction investigates *sociocultural process*[1] drawing on Vygotskian conceptions of social mediation in learning to write, including the role of semiotic tools, and on classical and contemporary interpretations of activity theory (Prior, 2006). Sociocultural theory is a major foundation of "situated" views of writing instruction emphasizing the appropriation of literacy practices through student participation in the activities of a writing community (Englert, Mariage, & Dunsmore, 2006). Studies conducted in the classroom have analyzed the forms of teacher scaffolding that support student literacy apprenticeship (Englert & Dunsmore, 2002), the co-construction of writing tools through teacher-student interaction (Allal, Mottier Lopez, Lehraus, & Forget, 2005), and the collaborative activity of students working on joint writing projects (Daiute & Dalton, 1993). In this direction of research, learning to write entails the concomitant development of cognitive competencies (skill in composing and revising) and of social identities (as an author, a co-author, a reviewer) in a writing community.

The fourth direction of research to be mentioned here concerns the *sociodiscursive dimensions* of the "didactics" of writing, as developed in the French language literature.[2] Analysis of the sociodiscursive nature of language, with reference to the theoretical contributions of Vygotsky and Bakhtin, among others, has highlighted the central role of text genre as a vehicle of cultural mediation in language use and learning (Bronckart, 1997). It has been proposed moreover to consider genre as the main "organizer" of the progression of teaching/learning activities in the language curriculum (Dolz & Schneuwly, 1996). Classroom research conducted in this perspective has led to the development of instructional sequences (*séquences didactiques*) aimed at fostering students' ability to produce different text genres while at the same time acquiring knowledge about the structure of oral and written language (Dolz, Noverraz & Schneuwly, 2001). Working in another framework (English language studies of writing and rhetoric), Bazerman (2004) has introduced the concept of "genre system" defined in terms of the relations between the "genre sets" produced by different participants in an activity system, whether in school or work settings. The classroom research he reports illustrates the process of co-elaboration that links students' genre sets (notes taken, texts written, worksheets filled out, etc.) and the genre set produced by the

teacher (instructions for assignments, assessment tools given to students, comments on student texts, etc.). This position is similar to that of Prior (2006) who states that, in school settings, teachers – through their interventions and interactions with students – are in fact "coauthors" of the texts students produce.

1.2 Co-regulation of writing in the classroom

Each of the four directions of research described above provides valuable insights for developing writing activities in the classroom. The model of co-regulation to be presented here draws in addition on some specific concepts developed in work on situated learning and cognition. A basic premise of the situated perspective is that "how" something is learned (the context, the social interactions, the tools and artifacts) are part of "what" is learned (Brown, Collins & Duguid, 1989). This has major implications for understanding teaching and learning in classroom settings (Allal, 2001).

Diverse theoretical approaches to situated learning and cognition have been developed by researchers working in the fields of psychology, anthropology, linguistics, education, and epistemology (Kirshner & Whitson, 1997). I will focus here on sources of conceptualization I have found to be particularly fruitful for studying co-regulation in the classroom, particularly during writing activities. The first is the interpretation by Newman, Griffith, and Cole (1989) of the Vygotskian concept of social mediation; their analysis emphasizes the bi-directional nature of appropriation during interactions between learner and teacher. This means (in my formulation): as the learner appropriates new skills under the teacher's guidance and scaffolding, the teacher also appropriates aspects of the students' actions into his or her on-going system of instruction.

A second source is the work by Cobb and associates (Cobb & Bowers, 1999; Cobb, Gravemeijer, Yackel, McClain, & Whitenack, 1997) in the area of mathematics education. Their analyses show how "whole-class discussions" (i.e., interactive exchanges led by the teacher with an entire class) allow the emergence of "taken-as-shared" meaning about the aims of the tasks to be undertaken, the disciplinary content under consideration, the practices and norms that are accepted and valued in the classroom. This notion overlaps in part with the proposal by Newman et al. (1989) that the "indeterminacy" of interactions is a key factor in the advancement of learning:

> Just as children do not have to know the full cultural analysis of a tool to begin using it, the teacher does not have to have a complete analysis of the children's understanding of the situation to start using their actions in the larger system. (p. 63)…. [In an instructional dialogue], the participants can act *as if* their understandings are the same. At first, this systemic vagueness about what an object "really is" may appear to make cognitive analysis impossible. However, it now appears that this looseness is just what is needed to allow change to happen when people with differing analyses interact. (p. 62)

Co-regulation, I believe, operates in a zone of indeterminacy. It implies an encounter between the teacher's attempts to provide resources that can help to regulate student learning and the students' attempts to integrate elements of instruction within their strategies of self-regulation.

In the model of co-regulation I have developed (Allal, 2007, see Figure 1), the learning environment includes three sources of regulation:

1. the *structure of the teaching/learning situation* (e.g., specification of writing goals; text genre under consideration; sequencing of whole-class, small group, and individual activities);
2. the *teacher's interventions and interactions with students* (e.g., whole-class discussions that prepare or follow tasks of drafting or revision; scaffolding offered to students who encounter difficulties while writing);
3. the *interactions between students* (e.g., reciprocal or collaborative peer review and revision).

At the core of this nested structure are the processes of *self-regulation* (cognitive, metacognitive, motivational…) occurring as each learner participates in the teaching/learning situation.
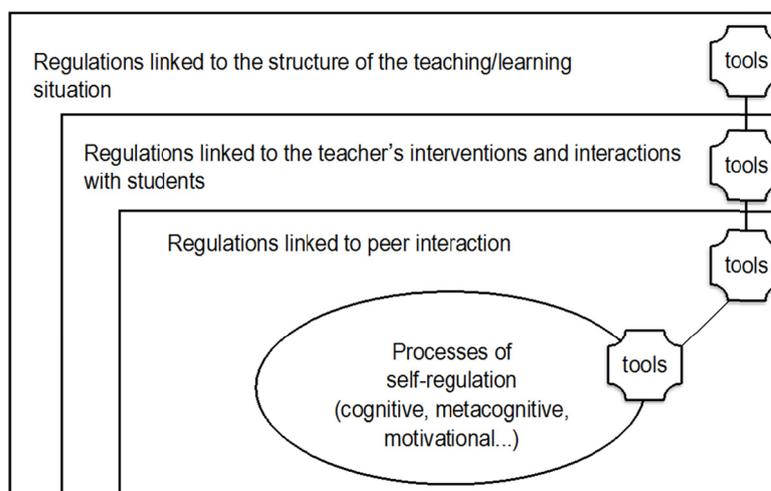

Figure 1. Co-regulation of student learning in classroom settings. (Source: Allal, 2007, reproduced with permission from De Boeck Supérieur S.A., translated by author).

As shown in Figure 1, *tools* are present at each of the levels mentioned above. Tools, which include cultural artifacts (e.g., dictionary), curricular materials, technological support systems, assessment instruments, have three functions. They assure *linkages* between the different levels of regulation. For example, a writing rubric selected by the teacher from curricular materials may become the focus of a whole-class discussion

where more specific evaluation criteria are defined; the resulting extended rubric can then be used by students for revision of their texts. Tools also *amplify* the effects of interactive co-regulation by making the goals more explicit and the activities of drafting and revision more systematic. In addition, they allow *recording of traces* of student activity that the teacher can later use for purposes of deferred regulation. For example, if students provide peer feedback using an online assessment form, the teacher can also consult the form and take the comments into account in subsequent interventions.

To summarize, co-regulation refers to the *joint* influence on student writing of contextual sources of regulation (structure of the teaching/learning situation, teachers' interventions and interactions with students, peer interactions, tools and artifacts) and of processes of self-regulation. This means that the sources of contextual regulation in the classroom can foster or hinder students' self-regulation, just as the students' strategies of self-regulation can amplify or restrain the role of sources of contextual regulation. To take a concrete example in classroom writing: a tool (e.g., guidelines for text revision) that is constructed interactively in a whole-class discussion can subsequently influence the way each student regulates his or her attempts at revising; at the same time, each student's initial conception of how to revise can shape the ideas included in the interactively constructed tool. The model in Figure 1 postulates that in any given "episode" of regulation (Sala-Bubaré & Castelló, 2017), self-regulation and contextual sources of regulation are both operational, even though they may not be equally salient.

Some researchers, notably Hadwin and Oshige (2011), have defined co-regulation as a transitional process based on scaffolding that leads to the learner's appropriation of self-regulation strategies as the outcome. In other words, the ultimate aim is student autonomy as a self-regulated learner. In the model I propose, co-regulation is both the means that allows learning to advance and the outcome (albeit an evolving outcome). Students are always learning new ways of participating in the joint regulation of classroom activities. To take an example in the area of classroom writing: although teacher scaffolding or tools of procedural facilitation may help students internalize a new strategy of self-regulation for revising their texts (e.g., a technique for checking subject-verb agreement), the extended use of the strategy will be invariably be reincorporated into new classroom writing activities where contextual factors – such as teacher valorisation of the strategy, peer reference to the strategy, tools that support the strategy – will influence its activation and its extension. Self-regulation is a component of the model I propose, but it always functions within a context of co-regulation of classroom learning. This means that the ultimate outcome, in school settings, is not "self-regulated learning," as proposed by Hadwin and Oshige (2011), nor "independent practice," as proposed in the SRSD model of Harris and Graham (1996), but rather student participation in progressively more advanced forms of co-regulated learning about writing.

2. A study of co-regulation of writing in elementary school classrooms

2.1 Research aims

This article presents findings from a study of writing activities in three elementary school classrooms. It has two aims regarding the co-regulation of writing:

1. to identify the sources of regulation emerging in the whole-class discussions led by the teacher and the influence of the discussions on students' subsequent text revision activity;

2. to analyze the roles of student self-regulation (as reflected in the revisions students carried out on their own drafts) and of peer regulation (as reflected in revisions made during interaction with another student).

With respect to the first aim, observed differences in the ways the teachers conducted the whole-class discussions were analyzed in relation to between-class differences in the deferred text revisions carried out by students. The second aim was addressed by analysis of the deferred revisions carried out by the students individually as authors and, subsequently, in interaction with peers. Qualitative data from recordings of peer interaction completed this analysis.

Classroom-based research of the type presented here gives priority to studying writing phenomena in a natural setting in order to capture the norms and practices that characterize the teaching and learning of writing. This approach has high ecological validity but also entails two limitations. First, it is difficult in natural settings to obtain observable indicators of many of the processes involved in writing. The focus in this article is thus on deferred text revisions (which result in visible text transformations) as a "window" on some, but by no means all, aspects of the co-regulation of writing. Secondly, the study did not implement an experimental design that would allow strict causal inferences. The interpretations presented here are therefore based on the degree of consistency of findings obtained by several methods (observations in the classrooms, analysis of text transformations, recording of peer interactions) and on the plausibility of the conclusions that can be drawn from the collected data.

2.2 Context and participants

The last years of elementary school (5th and 6th grades) are an interesting period in the development of writing skills in French-speaking Switzerland. It is in this period that the majority of students have acquired basic knowledge of the lexical aspects of spelling and learned most of the rules regarding the grammatical aspects of spelling (which are quite complex in French), and therefore begin to pay attention to other aspects of revision concerning text content and various aspects of text organization (Allal, Bétrix Kohler, Rieben, Rouiller Barbey, Saada-Robert, & Wegmuller, 2001).

The research presented here was conducted over a two-year period with the collaboration of three elementary school teachers (all women) working in public

schools in the canton of Geneva. Each teacher taught a 5th-grade class which she followed into 6th grade, thus allowing us to study a same group of students over two consecutive years. The classes were in schools located in a neighbourhood characterized by under-representation of families of upper socio-economic status (around 11%, as compared to 18% in the canton as a whole). Given the high mobility of families in this neighbourhood, only 38 students were present for all sessions of the writing activity in both 5th and 6th grades (12 students in class 1 and in class 2, 14 students in class 3). The 38 students included 21 boys and 17 girls, with an average age of 10 years, 10 months at the time of the study in 5th grade, and 11 years, 10 months in 6th grade. The students' nationalities (23 Swiss, 15 non Swiss) corresponded to the distribution in the overall school population of the canton (60% vs. 40%). The sample studied in each class had a similar composition.

The three teachers were volunteers who had similar professional profiles. They had already taken part in previous research and/or in the supervision of student teachers in collaboration with the university. As experienced professionals having taught in elementary school for over 20 years, they had participated in professional development activities in the area of language instruction and had already used the genre-based instructional sequences developed by Dolz et al. (2001).

2.3   The writing activity

The writing activity carried out in 5th grade and, a year later, in 6th grade is entitled "The Life of a Star."[3] In this activity, the students choose a star (in the area of music, sports, cinema, etc.) and write texts, as if they were the star, in response to questions from a journalist who wants to write an article for a magazine. It is stated that the star is too busy to meet the journalist and has therefore agreed to send written answers to the questions. The journalist's questions are:

- When and how did you begin to get involved in your activity?
- What was the most outstanding success of your career and why?
- What problems do you encounter as a star?
- What advantages do you have as a star?

The writing activity was designed with an authentic communication goal so as to encourage students to produce texts as interesting and as well written as possible. The text genre (a written, autobiographical interview) was familiar to the students since the magazines they read often present interviews with stars who talk about their life, past and present.

The writing activity took place in three sessions on three consecutive mornings. The teachers received a scenario prepared by the research team describing the aims of each session, the types of activities (whole-class discussion, individual work, work in dyads) to be conducted, as well as some more specific suggestions (e.g., a sample sentence to use for interactive practice of revision). It was recognized, however, that the

implementation of the activities would be influenced by the instructional and interactional practices of each teacher, as is generally the case in classroom research.

Session 1: Preparation

In preparation for writing, the teacher asked the students to bring magazines they read which included interviews with stars.

Whole-class discussion: The teacher explained the aims of the writing activity, had students present the magazine articles they had brought to class, and asked them to identify features that characterize this text genre.

Dyad: The teacher grouped the students in dyads and each dyad made its choice of a star to write about. Having the two members of a dyad write about the same star aimed at increasing their interest in reading, revising, and discussing their respective texts. The stars chosen included singers, actors, sports figures, TV celebrities, and a fictional character (Harry Potter). Since the students in each dyad chose a star they were interested in and tended to follow through various types of media, they could often include factual details about the star in their texts. The teachers stated, however, that they were free to imagine the responses the star could make to the journalist's questions. This meant that the text genre was more a fictionalized than a fact-based autobiographical interview.

Session 2: Producing the draft

Whole-class discussion: The teacher introduced the writing activity and led a collective "brain-storming" of ideas that could be included in the texts in response to each of the journalist's questions. She then led the composition of a Writing Guide in interaction with the class.

Individual: The students produced their drafts without interacting with their partners.

Session 3: Revising the draft

Whole-class discussion: The teacher introduced the activity of revision. She reminded the students to refer to the Writing Guide on the blackboard. In addition, the teacher led an interactive revision of a sample sentence (provided by the research team) that contained a variety of errors (concerning spelling, grammatical agreement, homophones, punctuation).

Individual: The students marked proposed revisions on the draft of their partner. They then revised their own draft (about the same star). The revisions were carried out separately on two photocopies of the drafts.

Dyad: The students confronted their texts and discussed whether they had imagined the star's life in similar or dissimilar ways. They then worked jointly on each text and discussed the revisions they had each made, as well as other ideas of revision that came to mind during the discussion. Each author marked the final revisions on his or her text.

The students used pens of one color during the individual revisions and pens of another color during their work as a dyad in order to allow subsequent differentiation for research purposes.

2.4 Sources of regulation in the writing activity

The writing activity was designed to include several contextual factors that could foster the regulation of students' writing and revision activity. For each factor in the model of co-regulation presented in Figure 1, the corresponding aspects in the writing activity "The Life of a Star" are indicated in Table 1.

The structure of the teaching/learning situation includes three possible sources of regulation. First, by reading and discussing examples of texts of the genre to be written, students learned about criteria that could orient their subsequent text production and revision. Second, the whole-class discussions and the exchanges in dyads provided occasions for social mediation of students' individual work on the drafting and revising of their texts. Third, the fact that the students revised their partner's draft before revising their own draft could stimulate new reflections that enlarge the scope of the revisions each author would carry out on his or her own text.

Table 1. Sources of contextual regulation present in the writing activity "The Life of a Star"

Sources of regulation linked to contextual factors	Writing activity "The Life of a Star"
Structure of the teaching/ learning situation	Reading and discussion of the text genre to be written Articulations between whole-class, dyadic and individual activities Revision of the draft of one's partner before revision of one's own draft
Teacher-student interactions	Whole-class discussions: elaboration of possible content, construction of a Writing Guide, interactive revision of a sample sentence
Peer interactions	Reciprocal and joint revisions by the members of each dyad
Tools	Writing Guide and revised sample sentence written on the blackboard (+ usual reference documents)

The whole-class discussions led by the teacher included several potential sources of regulation: (1) the collective elaboration of ideas that could be subsequently incorporated in each student's draft; (2) the interactive construction of a Writing Guide that could orient subsequent drafting and revising; (3) the interactive revision of a sample sentence written on the blackboard that could also give ideas for revision. The

peer interactions in the final phase of dyadic revision included two potential sources of regulation: reciprocal revision of the drafts written by each partner and joint revision of each text by the two members of the dyad, both of which could provide students with ideas for improving text quality. In addition, when the students were working individually and in dyads, they could refer to the tools collectively constructed (Writing Guide, revised sample sentence) and to their usual reference documents (dictionary, grammar handbook, etc.).

As the above description shows, the writing activity carried out in the three classrooms combined a number of components that could be expected to promote the co-regulation of writing and the enhancement of the quality of the students' texts. Several of these components correspond to factors that were found to have a significant average effect size in the meta-analysis of writing instruction in upper elementary school (grades 4-6) carried out by Koster, Tribushinina, de Jong, and van den Bergh (2015). The following factors (as labeled by Koster et al.) are present in the writing activity "The Life of a star":

(1) "Goal setting," which was made explicit in the whole-class discussions led by the teacher and in the collective construction of a Writing Guide;

(2) "Text structure," which was made explicit by the prewriting discussion of texts of the genre to be produced and by certain items in the Writing Guide;

(3) "Peer assistance," which was embodied in the reciprocal peer revisions and in the interactive joint peer revisions.

Koster et al. noted that "peer assistance" is a heterogeneous category that includes various ways of organizing peer review and response, some of which may be more effective than others. A study by Crinon (2012) in 4th- and 5th-grade classes examined the effects of different roles in peer review. His findings showed that the texts produced by students who were "advice givers" improved more than those of students who were "advice receivers." In the activity "The Life of a star," the students took on both of these roles. The members of each dyad annotated the draft of their partner with suggested revisions, and then received feedback from their partner in a discussion that could also allow joint formulation of revisions of each draft. In this respect "The Life of a star" is typical of many classroom writing activities where students are involved in both advice giving and advice receiving, as contrasted with formal situations of peer tutoring which entail differentiated roles.

2.5 Data collection

The analyses presented in this article are based on two categories of data: (1) data concerning processes during the writing activity (whole-class discussions and dyadic peer interactions); (2) data regarding outcomes, namely the transformations transcribed by the students on their texts during the session of text revision.

2.5.1 Data on interactive processes

Each year and in each class, a member of the research team observed the writing and revision sessions and took detailed notes on the way the activities were carried out. On the basis of each set of observations, a narrative protocol was established. Excerpts from two protocols are provided in Appendix A in order to illustrate the type of material collected. In addition, a transcription was made of everything written on the blackboard. A qualitative analysis was conducted by means of formats comparing the three classes with respect to potential sources of regulation resulting from the whole-class discussions. Appendix B presents a condensed format of information concerning the Writing Guide and the revision of the sample sentence.

During the phase of dyadic peer interaction, an audio recording was made of one student dyad in each class in 5th grade and of two dyads in 6th grade. Since the study was conducted in ordinary classroom conditions (i.e., without taking students out of the classroom), only a small number of dyads could be recorded by seating the students at a table in the back of the classroom. In 5th grade, the classroom teacher chose a dyad that, in her opinion, would interact constructively and accept to be recorded. In classes 2 and 3, the students recorded in 5th grade were also recorded in 6th grade but with another partner. In class 1, one of the 5th-grade students left the school; the teacher had the other student work with a new partner and, in addition, chose another dyad to record. The main purpose of the transcription of the recordings was to obtain qualitative data that would illustrate aspects of the analysis of the text transformations and/or allow discovery of processes that were not clearly reflected in the text transformations.

2.5.2 Data on text revision

The revision of a text is a complex process in which the reviser identifies potential problems and reflects about *possible* changes that are assessed with respect to their adequacy and relevance, some of which lead to actual changes of the draft while others do not. The process of revision thus includes, for example: correcting a spelling error but also verifying that a word is correctly spelled and therefore making no change; reformulating a sentence but also considering an alternative formulation and finally deciding not to make any change. In order for the concept of "revision" to keep this inclusive meaning, I have proposed using the term "text transformation" for the changes actually carried out (Allal, 2000). The transformations correspond to visible annotations, including corrections of errors, substitutions (e.g., changing the tense of a verb), additions and deletions, and reordering of text segments.

The analyses presented here were based on the written traces of the transformations transcribed, first, by the students individually on their partner's and on their own texts and, secondly, by each author on his or her text during the phase of dyadic peer interaction. These transformations therefore did not include online revisions that an author may have formulated during the drafting process. Moreover, the visible

annotations did not include revisions that the author, or the dyad, may have considered but decided not to implement.

An excerpt of a revised text is shown in Figure 2. The author's initial transformations written in blue ink are indicated in rectangles and the transformations made in red ink during the dyadic interaction are indicated in ellipses.

The analyses presented in this article are based on the classification of the transformations on three dimensions:

(1) Object of the transformation:
- Spelling: lexical and grammatical aspects (in French, the grammatical aspects include complex issues of gender and number agreement within a clause or a sentence); addition of a punctuation mark to an already segmented sentence was grouped with spelling;
- Text organization: relations between sentences and changes linked to text genre, including choice and coordination of verb tense and voice, anaphoric reference, transition words, punctuation linked to sentence segmentation (i.e., segmentation of run-on sequences of words into sentences by adding both a capitol letter and an end-of-sentence punctuation mark), reordering of segments or sentences;
- Semantics: transformations of content affecting the meaning of the text and lexical changes that nuance meaning;
- Miscellaneous or ambiguous.

(2) Origin of the transformation:
- Author: initial transformation carried out individually by the author;
- Dyad-peer: transformation written by the peer on his or her copy of the author's text, proposed during the dyadic interaction and copied by the author without any adjustment;
- Dyad-joint: transformation involving both members of the dyad, including transformation formulated by the students during the dyadic interaction (and which was not present in either of their individual revisions), or adjustment during dyadic interaction of a transformation initially made by the author or by the peer.

(3) Effect of the transformation on text quality:
- Positive (error corrected, or improvement with respect to coherence, clarity, enrichment of the text given the writing goal and text genre);
- Negative (error introduced or partially corrected, or change that diminishes text quality respect to coherence, clarity, enrichment of the text given the writing goal and text genre);
- Unclear (effect neither clearly positive nor negative).

Regarding the objects of transformation, a comment is in order with respect to terminology. Transformations of text organization and semantics are considered in

subsequent analyses as "higher-order" transformations because they concern attributes of the text, as contrasted with spelling transformations, which concern individual words or groups of words within the context of a sentence. The qualification "higher-order" does not necessarily imply a more complex transformation. Grammatical spelling in French entails complex issues of gender and number agreement, as well as many cases of grammatical homophones, that may be more difficult for students to master than some transformations of text organization (e.g., adding a transition word) or of text content (e.g., substituting one adjective for another). Higher-order transformations reflect nevertheless the reviser's concern for aspects of revision that go beyond localized error correction and in this respect can be an indicator of the emergence of a broader perspective on the aims of revision.

The coding of the object and the effect of a transformation involved classifying each transformation in the author's final text with respect to the definitions given above. The coding of the origin of a transformation was more complex. It required comparing three annotated drafts: the draft with the author's initial revisions, the draft with the peer's revisions, the final draft with the revisions the author marked during the dyadic interaction. As shown in Figure 2, the transformations in rectangles (blue ink) were those made by the author individually (coded Author); the ones in ellipses (red ink) were those the peer had made and that were added to the author's text during the interactions (coded Dyad-Peer); the one with two superimposed transformations (*suives + suivent*) concerns a transformation by the author that was changed during the dyadic interaction (coded Dyad-Joint).
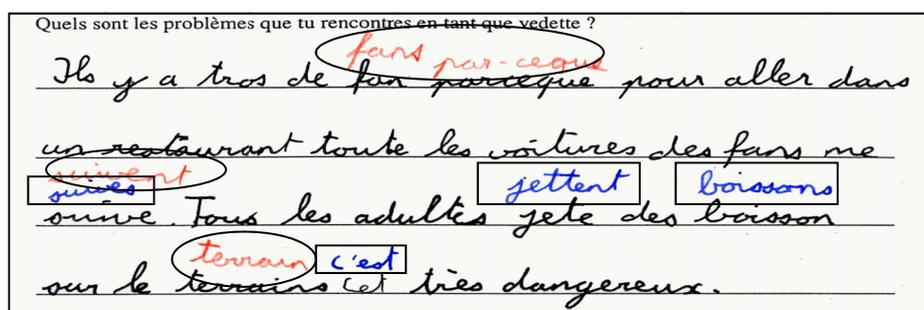

Figure 2. Sample of student revisions showing transformations carried out initially by the author (rectangles) and subsequently during dyadic peer interaction (ellipses).

Other cases of Dyad-Joint include: a transformation added during the interaction that did not appear in the individual revisions either of the author or of the peer; a transformations appearing in the peer's revision that was adopted in a modified way during the interaction.

The coding of the transformations was carried out by several members of the research team on the basis of a detailed codebook that included definitions of each

category, plus multiple examples added as the coding progressed. Here is one example (with explanatory comments added in brackets):

> When a first mark of negation is present (either *ne* or *pas/plus/guère*), addition of the second mark is coded as a spelling transformation. [Addition of the second mark completes the negative form in French].

> The addition of both marks (*ne* and *pas/plus/guère*) is coded as a semantic transformation. [Addition of both marks changes the utterance from an affirmation to a negation].

The degree of inter-coder reliability was quite high: 94.5% for the object of transformations, 88.2% for the origin of the transformations, and 88.3% for the effect of transformations on text quality. Cases of non-agreement were resolved by discussion among the team members and the solutions added to the codebook.

In addition, data were collected on the following characteristics of the initial and final texts produced (the percentage of inter-coder agreement is indicated in parentheses): number of words (100%), number of incorrect words (98%), number of incorrect words corrected (100%), number of words added or deleted (99%).

3. Results

3.1 Characteristics of the whole-class discussions

The observations in the three classes showed that the teachers followed the phases of the scenario provided by the research team. There were no major deviations with respect to the order of the proposed phases, the types of activities (whole-class, individual, dyad) or the general content. There were, however, important differences in the ways in which each teacher interpreted the scenario and developed the interactions with her class. The differences between the three classes were remarkably stable between 5th and 6th grades, which suggests that each teacher had developed well-structured, partially routinized teaching practices. The principle difference between 5th and 6th grades in all three classes was the increased use of linguistic and metalinguistic terminology in 6th grade (e.g., terms such as noun clause, homophone, and sub-categories of transition words). The analysis presented here focuses on the main differences between the classes with respect to the potential sources of regulation that could subsequently affect the students' writing and revision activity.

Elaboration of text content. The teachers of classes 1 and 2 led whole-class discussions in which the students proposed various examples of answers that could be given to each of the journalist's questions. The teacher of class 3 adopted a strategy that went further toward the interactive co-construction of potential text content. For several of the journalist's questions, she asked the students to discuss in small groups (3-4 members) what sorts of answers could be given; she then led a whole-class discussion

that drew on the ideas developed in the small-group exchanges. This technique increased the number of students who actively expressed ideas. The teacher also asked students who did not volunteer to express their ideas or comments, thus ensuring that almost very student contributed to the discussion. In addition, the teacher of class 3 insisted that the students express their ideas as if they were the stars, speaking in the first person, as required by the text genre to be produced. The class 1 and 2 teachers mentioned that the text was to be written in the first person but did not systematically require students to do so orally. (See illustrative excerpts in Appendix A).

Construction of the Writing Guide. All three teachers constructed the guide interactively with their class, but the procedures they adopted and the outcomes were quite different (see Appendix B). In class 1 and 2, the exchanges focused on language conventions (spelling, punctuation) and on some aspects of text organization (choice of verb tense, transition words). The students' contributions were closely guided by the teacher's questions and/or by key words that the teacher had written ahead of time on the blackboard. In contrast, the teacher of class 3 began with an open-ended question: "What do I need to think about when writing my text?" She wrote the students' suggestions on the blackboard from the viewpoint of the author composing a text. For example, in 5th grade:

>*I pay attention to spelling.*
>*I answer the questions.*
>*I write in a logical order.*

The teacher also asked questions about verb tense and transition words, and incorporated the students' answers into the guidelines:

>*Q. 1 & 2: imperfect, past compound tenses,*
>*Q. 3 & 4: present.*
>*Transition words: before, since, after, then…*

During discussion about what it means to revise a text, the teacher added a final indication in the Writing Guide:

>*I add, I delete, I improve the ideas.*

The Writing Guide in 6th grade included some new items suggested by the students, for example:

>*I avoid repetitions.*
>*I adopt the viewpoint of the star.*

When soliciting examples of transition words in 6th grade, the teacher asked first for examples of temporal transition words and added the students' suggestions (e.g., *previously, several years ago, today*) to the Writing Guide; she then asked for examples of logical transition words and added students' suggestions (e.g., *because, thus, that's why*). Although the guidelines were expressed in short, general statements, their potential semiotic role was enhanced by the multiple examples given orally by the students, as well as by the teacher's comments on the examples.

Emergence of taken-as-shared meaning of revision. The teacher of class 1 talked about revision as a "critical look" at one's draft. She nevertheless associated revision with exercises previously carried out in class that gave a rather narrow view of revision (e.g., exercises focused on the addition of adjectives to existing noun clauses). The teacher of class 2 introduced little explicit discussion of the meaning of revision in 5th grade; in 6th grade she stated that revision means improving the ideas and structure of the text in addition to correcting errors, but she did not elaborate or exemplify this statement. During the revision of the sample sentence provide by the research team, the teachers of classes 1 and 2 asked the students to look for errors and propose corrections. The writing guidelines formulated in these classes, as well as the revision of the sample sentence, suggested that the primary aim of revising was to assure the formal correction of a text. In contrast, the teacher of class 3 explicitly expressed the idea that revision is not just correction of errors, but also rewriting: "In addition, you can add words, make your text more interesting, delete words, improve the text, change what is written." During the interactive revision of the sample sentence, she had the students propose corrections of the various errors present in the sentence, but also asked them to give examples of elements that could be added, deleted or changed. In 5th grade, the students proposed a variety of additions and a possible change of verb tense. In 6th grade, they proposed various additions, a deletion, and an alternative syntactical construction (changing "and ask me for an autograph" to "while asking me for an autograph"). The interactive revision of the sample sentence in class 3 thus provided explicit modeling of revision aimed at rewriting.

It should be noted that the whole-class discussions in class 3 were considerably longer than those in classes 1 and 2. The average duration of the discussions that preceded the students' drafting of their texts was 52.5 minutes in class 3, as compared to 39.5 minutes in class 1 and 33.0 minutes in class 2. A longer duration of the discussions could in itself have an impact on the students' subsequent drafting and revision behavior. It is important nevertheless to consider what happened during the extra duration in order to understand how the discussions could influence student behavior. The longer duration in class 3 included two key activities: (1) the strategy in class 3 of having students discuss the questions first in small groups, and then in a whole-class format increased the time spend on elaboration of content and meant that more students were actively involved; (2) the construction of the Writing Guide in class 3 involved more oral exemplification by students of the items in the guide than in the other classes. In summary: the class 3 whole-class discussions were longer but also involved qualitative differences with respect to the other two classes.

3.2 Students' text transformations

The analyses presented below concern the distributions of the transformations with respect to their objects and their origins in the final versions of the students' texts, in each grade and in each class.

3.2.1 Objects of the transformations

Table 2 presents the data for 5th grade and Table 3 the data for 6th grade regarding the objects of the transformations. For each grade, the first part of the table provides the results of a chi square analysis of the distribution of the transformations across objects in the three classes. The tables give the cell frequencies and the percentages (by line); interpretation is based on the percentages, which reflect the relative frequencies of the different objects of transformation in each class. The second part of the table presents the mean frequency of each object per student in each class.

Table 2. Distribution of the objects of transformation, by class in 5th grade (cell frequency, % by line), and mean frequency of each object per student

			Object			
Class		Spelling	Text organization	Semantics	Misc.	Total
1	Freq.	137	12	8	9	166
	%	82.5	7.2	4.8	5.4	100
2	Freq.	156	21	16	2	195
	%	80.0	10.8	8.2	1.0	100
3	Freq.	125	62	40	3	230
	%	54.3	27.0	17.4	1.3	100
$X^2(6) = 67.842, p < .000$						
1	Mean	11.42	1.00	0.67	0.75	13.83
2	freq.	13.00	1.75	1.33	0.17	16.25
3		8.93	4.43	2.86	0.21	16.43

Class 1: n = 12; Class 2: n = 12; Class 3: n = 14

The chi square test in 5th grade (Table 2) indicates significant differences in the distributions ($X^2(6) = 67.842$, $p < .000$). The percentages (by line) show that class 3 students made relatively fewer transformations of spelling (54.3%, compared to 82.5% in class 1 and 80.0% in class 2), and relatively more transformations concerning text organization (27%, compared to 7.2% in class 1 and 10.8% in class 2) and semantics (17.4%, compared to 4.8% in class 1 and 8.2% in class 2). Students in class 3 students thus carried out relatively more higher-order transformations that concern features of the text (its organization and content), as contrasted with spelling transformations that operate at the level of single words or groups of words. The mean frequencies per student show the same pattern as the percentages by line: namely, on the average, there is a lower frequency of spelling transformations and a higher frequency of transformations of text organization and of semantics in class 3, as compared to the other two classes.

The chi square test in 6th grade (Table 3) indicates significant differences ($X^2(6) = 108.924$, $p < .000$) and the percentages (by line) show distributions that are similar to the ones in 5th grade. Class 3 students carried out relatively fewer transformations of spelling (32.5%, compared to 67.5% in class 1 and 72.7% in class 2), and relatively more transformations concerning text organization (31.7%, compared to 20.0% in class 1 and 17.4% in class 2) and semantics (34.9%, compared to 6.7% in class 1 and 7% in class 2). The mean frequencies per student show the same pattern as the percentages by line.

The data in Tables 2 and 3 also indicate that the mean of total transformations increased in class 3 between 5th and 6th grades, but decreased in the other two classes. The data in these tables reflect a general tendency in all classes of spelling transformations to decrease between 5th to 6th grade, and of transformations of text organization and content to increase.

Table 3. Distribution of the objects of transformation, by class in 6th grade (cell frequency, % by line), and mean frequency of each object per student

| Class | | | | Object | | |
		Spelling	Text organization	Semantics	Misc.	Total
1	Freq.	81	24	8	7	120
	%	67.5	20.0	6.7	5.8	100
2	Freq.	125	30	12	5	172
	%	72.7	17.4	7.0	2.9	100
3	Freq.	82	80	88	2	252
	%	32.5	31.7	34.9	0.8	100
$X^2(6) = 108.924$, $p < .000$						
1	Mean	6.75	2.00	0.67	0.58	10.00
2	freq.	10.42	2.50	1.00	0.42	14.33
3		5.86	5.71	6.29	0.14	18.00

Class 1: n = 12; Class 2: n = 12; Class 3: n = 14

To interpret the above findings, it was important to examine the frequency of spelling errors in the drafts produced by the students. If the class 3 students' initial drafts had many fewer spelling errors than the drafts of students in the other two classes, this could explain why the class 3 students could focus on higher-order transformation (text organization and semantics). A repeated measures analysis of variance was conducted to identify a possible class effect on the percentage of incorrect words in the initial drafts of the texts. This analysis showed that spelling errors decreased significantly in the three classes between 5th and 6th grades ($F(1, 35) = 65.524$, $p < .000$). The initial

drafts in class 3 had, on the average, relatively fewer spelling errors, but the difference between the classes was not significant ($F(2, 35)$ = 1.700, p = .198), and the grade X class interaction effect was not significant ($F(2, 35)$ = .762, p = .474). This means that the greater attention that class 3 students paid to text organization and semantics could not be attributed to significantly fewer spelling errors that needed correction in the initial drafts.

The question could also be raised as to whether the class 3 final drafts had more spelling errors than the final drafts of the other classes; if so, this could mean that the class 3 students' investment in higher-order transformations led them to neglect correction of spelling. A repeated measures analysis of variance on the percentage of errors in the final drafts showed a significant decrease from 5th to 6th grade ($F(1, 35)$ = 32.802, p < .000). The final drafts in class 3 had, on the average, relatively fewer spelling errors, but the difference between classes was not significant ($F(2, 35)$ = 0.900, p = .416), and there was no significant grade X class interaction effect ($F(2, 35)$ = 13.454, p = .347). These findings are thus consistent with the interpretation that the class 3 students' greater focus on higher-order transformations (text organization, semantics) did not lead them to neglect correction of spelling.

3.2.2 Origins of the transformations

Table 4 presents the data for 5th grade and Table 5 for 6th grade regarding the origins of the transformations. The structure of the tables is the same as that of Tables 2 and 3.

Table 4. Distribution of the origins of the transformation, by class in 5th grade (cell frequency, % by line), and mean frequency of each origin per student

| Class | | Origin of the transformation | | | |
		Author	Dyad-Peer	Dyad-Joint	Total
1	Freq.	69	76	21	166
	%	41.6	45.8	12.7	100
2	Freq.	81	54	60	195
	%	41.5	27.7	30.8	100
3	Freq.	132	55	43	230
	%	57.4	23.9	18.7	100
$X^2(4) = 38.299, p < .000$					
1	Mean	5.75	6.33	1.75	13.83
2	freq.	6.75	4.50	5.00	16.25
3		9.43	3.93	3.07	16.43

Class 1: n = 12; Class 2: n = 12 ; Class 3: n = 14

The chi square test in 5th grade (Table 4) indicates significant differences in the distributions ($X^2(4) = 38.299$, $p < .000$). In class 3, relatively more transformations were made by the author individually (57.4%), before the phase of dyadic interaction, than was the case in classes 1 and 2 (41.6% and 41.5% respectively).

The results for 6th grade (Table 5) are similar: 60.3% of the transformations were made individually by the author in class 3, as compared to 54.2% in class 1 and 32.6% in class 2. The distributions show, conversely, that dyadic interaction (Dyad-Peer and Dyad-Joint) was the source of relatively more transformations (as compared to Author transformations) in classes 1 and 2. The mean frequencies per student show the same patterns as the percentages by line. With respect to the transformations during dyadic interaction, the differences between Dyad-Peer and Dyad-Joint vary from one class to another without there being a consistently interpretable pattern.

Table 5. Distribution of the origins of the transformation, by class in 6th grade (cell frequency, % by line), and mean frequency of each origin per student

| Class | | Origin of the transformation | | | |
		Author	Dyad-Peer	Dyad-Joint	Total
1	Freq.	65	34	21	120
	%	54.2	28.3	17.5	100%
2	Freq.	56	52	64	172
	%	32.6	30.2	37.2	100%
3	Freq.	152	58	42	252
	%	60.3	23.0	16.7	100%
$X^2(4) = 39.129$, $p < .000$					
1	Mean	5.42	2.83	1.75	10.00
2	freq.	4.67	4.33	5.33	14.33
3		10.86	4.14	3.00	18.00

Class 1: n = 12; Class 2: n = 12; Class 3: n = 14

3.3 Relations between whole-class discussions and students' text transformations

In the analyses of the whole-class discussions and the students' text transformations, marked differences were observed between class 3, on the one hand, and classes 1 and 2, on the other. In class 3, the whole-class discussions prior to drafting were relatively long (nearly an hour). The teacher encouraged very active student participation in the elaboration of ideas for writing and in the co-construction of the Writing Guide. The teacher's interventions (questions asked, validations of student answers and proposals) during the construction of the guidelines and the interactive revision of the sample sentence emphasized the idea that revision entails correction of errors but also

possibilities for rewriting. The taken-as-shared meaning of "revision" that emerged in this class was thus quite broad. The text transformations that the students actually carried out, in the session devoted to revision, were consistent with the conceptions present during the whole-class discussions. Students in class 3 carried out a larger percentage of transformations concerning higher-order aspects of writing: content and text organization. They did not, however, neglect spelling: the percentage of uncorrected spelling errors in their final texts was lower, although not significantly lower, than in classes 1 and 2. It was observed, moreover, that a majority of the transformations in class 3 were made by the authors of the texts prior to their interaction with a peer, thus suggesting a relatively higher degree of self-regulation by the students in this class.

The findings with respect to classes 1 and 2 showed a different but equally consistent picture. The whole-class discussions were relatively short (30-40 minutes). Student participation was less extensive. The construction of the writing guidelines and the interactive revision of the sample sentence fostered a view of revision as a process aimed primarily at error detection and correction. The students' transformations were subsequently focused to a very large extent on spelling. The data also showed that the students in these classes displayed a greater tendency to draw on peer interaction as the major source of text transformations (mostly spelling corrections).

All of these findings support the idea that the whole-class discussions led by the teacher provided sources of regulation that influenced the subsequent revision activity undertaken by students: namely, the aspects of text revision to which the students paid attention and their attempts to implement text transformations. Moreover, whole-class discussions that were particularly rich and dynamic appeared to increase students' engagement in self-regulation (i.e., their attempts to revise various aspects of their own drafts prior to interaction with another student).

The question could be raised as to whether the observed differences between the three classes could be due to differences in the demographic characteristics of the students and/or the teachers. As indicated in section 2.2, this is not a very plausible explanation because the characteristics of the students were similar in the sample studied the three classes and the three teachers had similar professional profiles.

3.4 Self-regulation and peer regulation in revision

In the three classes, and in both grades, a substantial number of transformations were carried out during the phase of dyadic interaction (n = 580), in addition to the transformations made individually by the authors on their initial drafts (n = 555). In other words, peer regulation during dyadic interaction tended to amplify students' investment in revision beyond the level of individual self-regulation. The impact of the transformations on text quality was nearly identical for peer and self-regulation. The effect was positive (error accurately corrected or other revision judged to be an improvement) for 82.6% of the transformations made during peer interaction and for 82.5% of the transformations made initially by the author. The percentages of negative

or unclear effects were also nearly identical for the transformations during peer interaction (negative: 11.7%, unclear: 5.7%) and for the author's initial transformations (negative: 11.5%, unclear: 5.9%).

It is of interest to find out, however, whether the transformations resulting from peer interaction are of the same type as those carried out by an author individually. In Table 6, based on data from the three classes and both grades, the objects of the transformations are crossed with their origins. The chi square test indicates significant differences in the distributions ($X^2(6) = 34.15$, $p = .001$).

Table 6. Distribution of the transformations by object for each origin (cell frequencies, % by line)

Origin			Object			
		Spelling	Text organization	Semantics	Misc.	Total
Author	Freq.	328	116	103	8	555
	%	59.1	20.9	18.6	1.4	100
Dyad-Peer	Freq.	237	59	23	10	329
	%	72.0	17.9	7.0	3.0	100
Dyad-Joint	Freq.	141	54	46	10	251
	%	56.2	21.5	18.3	4.0	100
$X^2(6)=34.15$, $p = .001$						

The percentages for Author and Dyad-Joint show very similar distributions. This means that when authors carried out transformations individually or when they produced joint transformations with another student, the objects dealt with presented a similar profile (56-59% spelling, 21-22% text organization, 18-19% semantics). In contrast, when the transformations came from peer proposals (Dyad-Peer), there was a marked tendency to focus on spelling (72% of the transformations) and to avoid transformations of text content (only 7% of the transformations).

These findings suggest that student self-regulation, as reflected in the revisions carried out by an individual author, can be enhanced by peer regulation that involves joint production of revisions, but may suffer a restriction of scope if peer regulation is reduced to reciprocal suggestions of error correction.

3.5 Qualitative data from the recordings of the dyads' interactions

Although the dyads chosen for recording by the teachers cannot be considered as globally representative of their classes, the recordings are a source of interesting qualitative data in two respects. First, excerpts from the recordings provide concrete illustrations of how different types of transformations were carried out. Second, the recordings shed light on some processes that are not apparent in the analysis of visible

text transformations and thereby allow a more in-depth understanding of the dynamics of interactive peer revision. All names in the examples are fictive.

3.5.1 Illustrations of transformations during dyadic interaction

Spelling. Transformations of spelling during dyadic interaction resulted principally from peer proposals. As the peer reviewed the corrections noted on his (or her) copy of the author's text, the author most often accepted the proposals with minimal comment, but sometimes asked questions or expressed objections. For example, in class 2, 6th grade, Kristina accepted and copied on her text 10 spelling corrections proposed by her partner, Tania. Half of the corrections concerned past participle agreement (a complex aspect of grammatical spelling in French). Kristina made several comments showing that she was not blindly copying what Tania proposed. For one case, Kristina asked to check in a reference manual, and she later remarked in a self-reflective way: "Ah, always the same mistakes for the same thing."

Corrections of spelling errors were sometimes carried out on the basis of contributions from both students. For example, in the draft written by Samuel (class 3, 5th grade), a sentence with a plural subject (*les paparazzi* – a word, with its plural article, written on the blackboard during the whole-class discussion) was followed by a singular verb (*se gène*). When revising his own text, he attempted a correction but used the wrong verb inflection *(-es* instead of *-ent)*. During the dyadic interaction, his partner Mourad remarked that he didn't notice the mistake when he revised Samuel's text but that the change Samuel made was not right: *"-es* would go with *tu* [you]". They checked in a verb conjugation table but didn't find the verb they were looking for. In the end, Samuel agreed with Mourad and wrote the verb with the correct *-ent* ending. The incorrect accent (*gènent* rather than *gênent*) was not noticed, however, by either student.

Text organization. Many of the text organization transformations concerned the seg–mentation of sequences of run-on words into distinct sentences. Although this is a very basic type of revision, it is one that many 5th and 6th grade students do not master and is a first step toward producing a coherent and easily readable text. Here is one example. In the text written by Tania in 5th grade, class 2, she answered the journalist's first question with a sequence of 55 words. Her partner Stephan proposed to segment this sequence in three sentences (with capital letters and periods), which Tania agreed to and marked on her copy of the text.

The use of transition words (which all the teachers had emphasized in the construction of the Writing Guide) was also a topic in the dyads' interactions. For example, in class 1, in 6th grade, when Mehdi revised his text, he replaced "And" by the word "Then" at the beginning of a sentence ("Then it's thanks to this that I am

famous…"). In the dyadic interaction, his partner proposed a more specific transition word ("Finally"), which Mehdi willingly adopted.

Other transformations of text organization concerned the coherence of verb tense across sentences and with the journalist's questions. In some cases, the students expressed arguments for different solutions. For example, in class 2, 6th grade, in response to the journalist's second question ("What was the most outstanding success of your career and why?"), Kristina wrote: "I played in a film that is entitled Austin Power…." Her partner Tania proposed that it would be better to write "that **was** entitled Austin Power…;" she referred to the Writing Guide which indicated use of the past tense for this question. Kristina argued that the present tense was possible because "It's still the film, it hasn't disappeared." But she finally agreed to change to the past tense. Above and beyond the question as to which tense is preferable, it is interesting to note that these 6th-grade students were weighing alternatives and formulating arguments, which is a perspective on revision that goes beyond mere error correction.

Semantics. When student authors revised their own texts, they sometimes made quite long additions of content (of up to 50 words). During the dyadic interactions, on the other hand, the discussion of text content did not necessarily lead to transformations, and when changes did occur they were generally very short additions or substitutions that nuanced text content rather than enlarging or modifying overall meaning. For example, in class 3, 6th grade, Samuel and Vera discussed differences in the way they had each answered the journalist's first question (for Samuel, the singer's mother was sick; for Vera she was dead), but no change was made in either text. As Vera commented: "If she's sick, then maybe she's going to die, it depends on what sickness." Subsequently, Samuel proposed three modifications regarding Vera's text, which she accepted: (1) changing "a fairly moving song" to "a very moving song"; (2) adding the name of a singer ("Eve") with whom the star had sung in duo; (3) changing "a lot" to "enormously." Vera also proposed an addition to Samuel's text: "and that tires me a lot" as a follow-up to "I receive ten fan letters a day." Although these additions and substitutions are quite minor modifications by expert standards, they reflect the emergence of young writers' understanding that interactive peer revision can include transformations of content in addition to error correction.

3.5.2 Insights regarding interactive revision
The recording of the dyadic interaction between two boys in 5th grade, class 3, provides two insights that deserve mention. The first concerns the interplay that can occur between peer regulation and self-regulation. Table 7 presents an example of peer regulation by Mourad and self-regulation by Samuel during their interaction regarding Samuel's text. Indicators of peer regulation are written in italics (green) and indicators of the author's self-regulation are in bold (blue).

The exchange unfolded as follows. While reviewing Samuel's text, Mourad asked a question that pointed to an error, but did not provide the correction (line 1). This allowed Samuel to recognize the error and correct it himself (line 2); he had confused two grammatical homophones and changed *ses* (his) to *c'est* (it is). As Samuel continued reading his text (lines 3-4), Mourad intervened saying "It's correct." (line 5). But Samuel pursued his self-assessment: verifying that "clothes" is plural, whereas a "piece" of clothing is singular (lines 6-7). Mourad confirmed Samuel's reasoning (line 8), but then brought up a new question (line 9). For the word "piece" (*bout* in French), is a circumflex accent needed on the "u"? This is a relevant question because similar words in French – for example *goût* (taste) – have this sort of accent. Samuel proposed a means of verification (checking in the dictionary – line 10), and Mourad volunteered to do the checking (line 11).

Table 7. Excerpt illustrating interplay between peer regulation and self-regulation during revision

🟩 *Indicators of peer regulation*	🟦 **Indicators of self-regulation by the author**

1 Mourad	***What's that? What's written there?***
2 Samuel	**There, I made a mistake…OK, I've corrected it.** (ses→c'est)
3	(He reads): "It's very annoying. What annoys me is that the fans, the fans, the
4	fans…"
5 Mourad	***It's correct.***
6 Samuel	"…tear my clothes, **e-s**, in order to take a piece, **p-i-e-c-e…"**
7	**so, no s? Yeah, there's only one piece.**
8 Mourad	***Yes.***
9	***But I think there's an accent missing.*** (piece = bout or boût?)
10 Samuel	**…Wait. We look in the dictionary?**
11 Mourad	***OK. I'll look*** (he opens the dictionary and starts searching).

To summarize: as seen in this excerpt, peer regulation included asking open-ended questions (line 1), raising new issues (line 9), providing confirmatory feedback (lines 5 and 8), and agreeing to implement a verification procedure (line 11); self-regulation by the author included self-correction (line 2), analytical reflection (lines 6-7), and proposal of a verification procedure (line 10). The synergy seen in this excerpt does not occur frequently in the recorded dyadic interactions; there are more instances where the peer indicates revisions written on his (or her) copy of the author's text and the author agrees with minimal comment. This excerpt provides nevertheless an illustration

of the articulation between self-regulation and peer regulation that teachers could aim at fostering, as will be discussed in section 4.

The recording of Samuel and Mourad's interaction offers a second interesting observation. The two students spent only 3 minutes on Mourad's text. Samuel agreed with all the transformations Mourad had made, except one; he explained why but Mourad did not accept his argument. The result was that no new transformations were added to Mourad's text during the dyadic interaction. During the 26 minutes devoted to the discussion of Samuel's text, 13 transformations were added in addition to those made previously by Samuel. Mourad took on a very active role in the discussion: he made suggestions, gave feedback, raised questions for discussion, provided explanations of his viewpoint, carried out verifications in tandem with Samuel. In other words, although the dyadic interaction led to no improvement of Mourad's text, it did provide an occasion for him to invest in sustained reflection about various aspects of his partner's text and may have thus contributed to his own understanding of revision. Other research has shown that "giving advice" (Crinon, 2012) or even observation of other students' work (Rijlaarsdam et al., 2008) can be beneficial for the development of students' writing skills.

A more general observation can be drawn from the recordings of the dyads in all three classes, namely that the transformations visible on the students' texts often underestimated the students' investment in the process of revision. This occurred primarily in two situations. (1) When the students reviewed the transformations made by the author (the majority of which were correct), most of their exchanges did not lead to any visible annotations. (2) The students sometimes carried out systematic verifications throughout a text independently of the annotations made by each student prior to the phase of dyadic interaction. One example was the use by dyads in the three classes of a checking device that the students had learned to distinguish the infinitive and past participle forms of verbs (i.e., oral replacement of homophone verb forms, such as *chanter vs. chanté*, by forms that are not homophones, such as *vendre vs. vendu*). Since the majority of the verifications led to confirmation of what the author had written, few modifications were added to the text. In both of the above situations, the transformations written on the texts did not fully reflect the time and effort students spent using linguistic knowledge for the purpose of revision.

One final comment concerning the potential benefits of interactive dyadic revision. In the three classes, the students generally spent at most 20 minutes, sometimes as little as 5 minutes, on the individual revision of their own texts and were rarely willing to spend more time, even when the teacher encouraged them to do so. Interactive dyadic revision, lasting 10-30 minutes, in addition to individual author revision, can thus have two potential benefits. The first is the addition transformations that improve the quality of the student's text, which happened in the case of the large majority of dyads. But even when this does not occur (as, for example, in the case of Mourad's text in the interaction with Samuel), dyadic revision can spur both students to engage in sustained

reflection about various language issues involved in writing and may thus foster progress in students' understanding of revision.

4. Conclusions and perspectives

The model of co-regulation I have presented (Figure 1) emphasizes the joint influence on student writing of sources of contextual regulation and of processes of self-regulation. The data collected in three elementary school classrooms, at two points in time (grade 5 and grade 6), concerns two aspects of co-regulation: (1) the role of whole-class discussions in the emergence of taken-as-shared meaning regarding revision and the influence of these discussions on the revisions subsequently carried out by students; (2) the articulations between self-regulation (reflected in revisions students carry out individually on their own drafts) and regulations resulting from peer interaction (reflected in revisions made during peer interaction). On the basis of the analyses and the discussion of results in section 3, it is possible to formulate the following conclusions regarding the co-regulation of writing activities in upper elementary classrooms.

Classroom observations showed that several aspects of whole-class discussions led by the teacher appeared to contribute to the regulation of subsequent student revisions. When the teacher encouraged active student involvement in pre-writing activities (generation of ideas, construction of writing guidelines, revision of a sample sentence), all of which contributed to the elaboration of taken-as-shared meaning regarding the aims of revision, students tended to adopt more complex strategies, as reflected in more numerous transformations concerning higher-order aspects of revision (text organization and semantics), in addition to error detection and correction of spelling.

The links between student self-regulation and peer regulation were examined on the basis of the transformations carried out and the students' dyadic interactions. In the sequence implemented in the three classrooms, the students, grouped in dyads, wrote on a same topic, reviewed their partner's text, revised their own text, then confronted and discussed the revisions of each text with their partner. The data showed that interactive peer regulation generally amplified self-regulation by leading students to examine and take into account a larger number and variety of revisions than what they had considered individually, as authors. It was also found that when peer regulation involved joint elaboration in which both students were engaged, a relatively wider range of objects was dealt with (more transformations of text organization and semantics, in addition to spelling) than when peer regulation consisted of reciprocal proposals of corrections. Although self-regulation and peer regulation can work in tandem (e.g., excerpt in Table 7), joint elaboration was not the dominant mode of revision in the data concerning all dyads; reciprocal error correction occurred more frequently and tended to narrow the focus of revision to concerns about spelling (Table 6). This suggests that teachers need to be aware that peer feedback and interaction can have variable effects, depending on how it is carried out.

With respect to the above findings, I will discuss three issues – expressed as questions – in relation to evidence coming from other research on students learning to write, particularly in the upper elementary grades.

First, how should the student's role be conceived in writing instruction? Experimental studies of writing instruction (Graham, 2006; Koster et al., 2015), as well as large-scale implementation studies of writing programs (Reitdijk, Janssen, van Weijen, van den Bergh, & Rijlaarsdam, 2017), have shown that explicit teaching of writing strategies has significant effects on the development of students' writing skills. The writing sequence "The Life of a Star" included extensive prewriting activities. These activities carried out in a whole-class format led by the teacher are a form of instruction, but they had two characteristics that are not usually emphasized in explicit strategy instruction: (1) the inductive nature of the activities (e.g., discussing examples of magazine articles to allow students to discover the characteristics of the genre to be produced); (2) the emphasis on student participation (e.g., building the writing guidelines on the basis of student proposals; modeling of revision of a sample sentence through teacher-student interaction). These characteristics are coherent with a situated perspective on the co-regulation of student writing, but their impact cannot be precisely assessed on the basis of the design of the study conducted. To better understand the role of induction and of student participation in writing instruction, further research – both (quasi-)experimental and of a qualitative, process-tracing type – is needed.

Second, what sort of professional development activities can best contribute to teachers' expertise in the co-regulation of student writing? In the study presented here, there were substantial variations between teachers in the way they implemented the proposed instructional sequence. Between-teacher variations are widely observed in educational research and have led Rietdijk et al. (2017), to adopt a dual position regarding the conditions for implementing innovative writing instruction. They argue that a writing program should allow leeway for teachers to introduce adaptations in line with their pedagogical beliefs and contextual constraints and, at the same time, professional development and coaching support should be provided to encourage the development of new skills and classroom practices in line with the aims of the curriculum. With respect to the co-regulation of writing activities, professional development could assist teachers in developing skills that are rarely addressed in preservice teacher education, such as:

- how to lead dynamic whole-class discussions that prepare and follow up on student activities of composing and revising; ;
- how to model writing and revision behaviors not only in front of, but in interaction with students.

Research on professional development has identified several features that have positive effects on classroom teaching, one of which is "opportunities for active learning" (Garet, Porter, Desimone, Birman, & Suk Yoon, 2001). In a year-long intervention study designed to help 7th-grade teachers develop co-regulation of writing in the classroom (Bourgeois, 2016), active professional learning was encouraged in two ways: (1) by

discussions between teachers of selected student texts and of ways to foster improvement of student writing; (2) by providing teachers with tools to scaffold student involvement in self- and peer assessment of writing. The results, documented by qualitative case studies, were mixed: co-regulation of writing was enhanced in some classrooms, but not in others where the teacher remained focused on the requirements of summative assessment. The large-scale study by Rietdijk et al. (2017) found a direct effect of professional development on the number of proposed writing lessons that the teachers implemented, but no direct additional effect on student writing performance. They suggest that research needs to include observations and qualitative measures of how writing lessons are implemented.

Third, how can peer revision contribute to learning to write? The writing sequence "The Life of a Star" proposed a format of peer revision that involved reciprocal revision followed by face-to-face discussion, rather than mere transmission of feedback, as in many peer review procedures. Research on peer-based review, feedback and assessment has been conducted primarily in higher education, but a number of studies have examined its role in writing activities in upper elementary grades (see reviews by MacArthur, 2016, and by van Zundert, Sluijsmans, & van Merriënboer, 2010). One important finding is that peer revision is more likely to have a positive impact on student writing when it is coupled with explicit instruction in the use of strategies and/or explicit specification of criteria for revision (MacArthur et al., 1991). In the writing sequence "The Life of a Star," the interactive revision of a sample sentence was a quite limited form of instruction in preparation for student revision. Interactive modeling of revision could be reinforced in two ways in order to foster higher-order revisions of text organization and content, in addition to spelling. The first would be to carry out the revision on paragraphs of several sentences (constructed to contain various types of problems). This could take place in three steps: (1) modeling by the teacher of revision of a paragraph in front of the class; (2) revision of another paragraph by students in small groups, so as to maximize student participation; (3) interactive revision of a third paragraph in a whole-class discussion that combines student participation and teacher modeling. Secondly, to encourage joint elaboration of revisions during peer interaction, students could receive a checklist of prompts regarding questions to ask one's partner (*What do you think? Why do you say that? How can we check/decide? How can we make it more interesting for the reader?*) and ways of responding (*I think this because…, I don't agree because…, I suggest that…*). This does not mean that reciprocal error correction focused on spelling would disappear: if a peer points out an error that the author immediately recognizes and knows how to correct (e.g., adding "s" on a plural word), there may be no reason for further discussion. Nevertheless, the research presented here suggests that joint elaboration can foster revisions of text organization and content and thereby contribute to the development of more advanced expertise in writing.

In summary, a goal for future research and instructional development should be to find ways of more effectively linking the cognitive and social dimensions of learning to write in the classroom.

Notes

1. Under the heading "sociocultural theory," Prior (2006) discusses the differences and commonalities between sociocultural, sociohistoric and cultural-historical views of writing.
2. A review of French-language research in the area of "la didactique de l'écrit" is presented by Daunay (2007).
3. I have translated from French to English the indications about the writing activity and the data appearing in this paper.

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Appendix A

Two excerpts from the narrative observation protocols concerning the elaboration of text content in Session 2, Question 2, 6th grade

Excerpt - Class 1.
Teacher starts the whole-class discussion concerning Question 2: "So, what sorts of successes could happen in the life of a star?"
Student: "A concert competition."
Teacher: "Try to explain."
Student: "Get first place in a competition."
Another student raises her hand. Teacher asks: "Do you have another idea or do you want to follow up on her idea?"
A series of ideas are proposed by different students (non exhaustive examples):
"The team wins the World Cup."
"During her tour, she meets a famous movie star."
"A song becomes a big success."
"A TV presenter on a well-known program, and then he has fans."
Summary: Teacher stimulates the students to give a variety of ideas and sometimes intervenes to guide elaboration of their proposals ("Try to explain"). Students often speak in third person.

Excerpt - Class 3.
Teacher asks a student to read Question 2 ("What was the most outstanding success of your career and why?")
She then asks the students to get in groups of 3-4 and discuss possible answers to the question. She moves among the groups, and encourages discussion.
All groups interact intensely for about 5 minutes, except one where students stop exchanging after a couple minutes.
Teacher initiates a whole-class discussion and asks the students to share the ideas that came up in their group about the star's most important success.
Many hands go up.
Proposals by different students (non exhaustive examples):
"My first album."
"I received lots of fan mail."
"When I was invited to sing at Johnny Hallyday's birthday."
"When I saw my mother weep at my concert."
"My fans threw lots of things at me."
"I saw my face in all the magazines."
Teacher asks: "And if the star is in sports?"
A student proposes: " When I received my 7th gold medal."
Several other students express ideas.

Summary: Small-group discussion before whole-class discussion increases student participation. Teacher stimulates students to give a variety of answers ("And another idea?"), calls on students who don't volunteer, but does not comment on the proposals. Students speak systematically in first[t] person, as the star.

Appendix B

Writing Guide constructed and Interactive revision of the sample sentence during the whole-class discussions, by class, in 5th and 6th grades

Activity	Class 1	Class 2	Class 3
Writing Guide Items written on the blackboard (*) = examples or details added on the blackboard	5th - Verb tenses (*) - Transition words - Spelling (*) - Punctuation - Legible handwriting	5th - Write at least 3 sentences per question - Verb tenses (*) - Transition words (*) - Spelling (*) - Punctuation - Presentation - Syntax	5th - I pay attention to spelling (*) - I pay attention to punctuation - I write legibly - I answer the questions - Verb tenses (*) - I write in a logical order - Transition words (*) - I add, I delete, I improve ideas
	6th - Spelling (*) - "I" + Verb tenses (*) - Temporal transition words (*) - Logical transition words (*)	6th Structure - Verbs: "I" + tenses (*) - Transition words . temporal (*) . chronological (*) . logical (*) Spelling (*) Punctuation	6th - I avoid repetitions - I adopt the viewpoint of the star - I use "I", or "we" - I check spelling (*) & grammatical agreements - I write events in chronological order - I put punctuation (*) - I use transition words . temporal (*) . logical (*) - Q1-2: I write in past tense - Q 3-4: I write in present tense (or past)
Interactive revision of the sample sentence (written on blackboard)	5th Corrections only	5th Corrections only	5th Corrections plus additions, a change of verb tense
	6th Corrections only	6th Corrections only	6th Corrections plus additions, a deletion, a syntactical transformation