

Peer Editing in French Using Digital Tools: A Micro-Analysis of Learner-Computer Interactions

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Abstract

This paper describes a case study focused on the ways in which university-level learners of French as a second language collaborate during peer-editing sessions assisted by digital tools. The purpose of the study is to better understand users' interactions with each other and with technologies at a micro level. Audio recordings and video screen captures of peer-editing sessions serve as a basis for our analysis of strategies deployed by 12 learners of French as a second language enrolled in an intensive intermediate grammar and writing course. Using a mixed-methods approach based on qualitative and quantitative data collected with five peer-editing groups, the study centres on processes in which participants engage to perform their tasks. The paper makes recommendations regarding task design and learners' training for development of digital literacies.

Résumé

Cet article présente une étude de cas portant sur les stratégies utilisées par des apprenants de français langue seconde en milieu universitaire, lors de séances de correction des pairs assistées par des outils numériques. L'objectif de l'étude était de mieux comprendre, à un niveau micro, les façons dont les participants interagissaient entre eux, ainsi que d'identifier les interactions avec les outils numériques utilisés. Pour ce faire, nous avons eu recours à des enregistrements audio et à des captures d'écran de séances de correction des pairs pour analyser les stratégies mises en œuvre par ces étudiants inscrits dans un cours de grammaire et d'écriture de niveau intermédiaire. À partir des données d'ordre quantitative et qualitative recueillies auprès de cinq groupes d'apprenants, cette étude s'est concentrée sur les procédés auxquels avaient eu recours les participants pour accomplir la tâche. L'article offre des recommandations sur les conceptions de tâches et sur la formation à la littératie numérique.

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Introduction

In today's digital age, educators have recognized the need to assist learners in developing proper digital literacy skills (Gee & Hayes, 2011; Selber, 2004). While computer programming has become part of many academic programs housed in the sciences departments, the added value of computers, as a primacy space to work, has yet to be the norm in the humanities or the arts. However, as already remarked by Selber (2004), building proper digital literacy abilities goes beyond the need to learn to program; it also includes the development of writing and research skills. Selber further described computers as a "kind of prosthetic device that increases efficiency, enhances cognition, and spans temporal and spatial boundaries" (p. 36) for which the "context of use deserves as much recognition as the context of design" (p. 93). Thus, there is an urgent need to look at technology as a cultural artefact with which and through which individuals communicate or work with each other. Documenting the ways in which learners collaborate during digital writing activities is one way to help achieve the goal of training future students to become competent members of a digital society.

The present study relates to previous work in the area of computer-mediated communication (CMC) and digital writing research within the environment of second language (L2) learning. While many studies have focused on peer/self-editing using traditional and non-traditional resources to explain processes, gather learners' perceptions, and make recommendations on tasks, few studies have concentrated on learners' product(s) and processes, taking a micro-view to better understand their abilities to perform the task required. Thus, the present study differs from previous work because it presents a very detailed micro-analysis of interactions (captured via audio recording [AR]) between participants who are collaborating on a peer-editing task, and interactions (captured via video screen captures [VSC]) between these students and the digital tools that they are using (such as online dictionaries or online editing applications).

Based on previous research that analyzed learner-computer interactions (e.g., Caws, 2013; Dejean, 2003; Hamel, 2012), the hypothesis motivating the present study is that language learners need more formal training in using digital resources than instructors typically recognize. The implication of this research is dual: (a) on a practical level, taking a micro-view to observe learners while they are performing technology-mediated learning tasks contributes to a deeper reflection on tasks design, learning outcomes, and learners' adaptability in using digital artefacts; and (b) on a theoretical level, a micro-analysis of interaction patterns and learners' strategies may offer new perspectives on the concept of interactions and the complex nature of technology-mediated activities.

Context

Within the field of computer-assisted language learning (CALL), researchers have argued that a holistic approach to learning design will lead to a better understanding of what learners actually do when they are engaged in technology-mediated tasks that have been assigned to them and/or in which they have decided to engage as a result of an alternate activity (e.g., Bertin & Gravé, 2010; Raby, 2005). Addressing the wider context of

education (at the primary and secondary levels), Warschauer (2011) asserted that, “if we wish to increase academic achievement, students should principally use the computer as a tool to *think with* . . . rather than as a tutor” (p. 10, emphasis added). Indeed, in too many cases, technology is still used in the classroom as a means to save time. For instance, in language courses, it often translates into activities for which students will be assigned online exercises (such as *fill in the blank* or *multiple choice* practices) to do outside of class without any specific tasks to reflect on the exercises. One can only wonder whether such uses of technology can adequately prepare learners to become innovative users of the many digital tools that they have at their disposal.

In language education settings, digital technologies—especially Internet-based resources and artefacts—have become ubiquitous. Learners live and breathe with digital tools without being aware that they actually do. It seems obvious, and maybe too obvious, that instructors may easily utilize these various digital resources or artefacts as an integral component of language-learning environments. However, successful and effective integration of technology in the classroom requires careful analysis, design, implementation, and evaluation (e.g., Colpaert, 2006). Hubbard (1996) framed this need for an integrated approach by devising a methodological framework for CALL that included an evaluation module designed to assess the learner’s fit and the teacher’s fit with language-learning software. Likewise, Levy and Stockwell (2006) linked evaluation and design by identifying an obvious intersection of the two concepts. They emphasized important features of evaluation by suggesting that evaluation studies “have a practical outcome” and “draw value from the process as well as from the product of the evaluation” (p. 42).

The current diversity of educational contexts and the wealth of digital technologies motivate the ever-growing need for research-based evaluation of the complex interactions between subjects, artefacts, and contexts. Consequently, in order to improve the integration of digital tools into L2 learning settings, we need to continue to carefully evaluate the processes and products that derive from such interventions (e.g., Geisler & Slattery, 2007; Hamel, 2012; Hamel, Séror, & Dion, 2015).

Studies in digital writing research and composition (often within the context of English as a first or second language) have gone a long way in including, testing, or evaluating environments and specific tools for learning, as well as informing the research community about ways to code data that new technologies can help collect (see McKee & DeVoss, 2007). In their study on editing and revising French written work, Cordier-Gauthier and Dion (2003) compared students who used computerized word spellers to students who relied on their cognitive skills to edit their papers. They concluded that skills required to edit with a computerized system differed quite drastically from those used by students in the control group. In addition, the study revealed that no computerized systems could fully replace the human skills in terms of editing and correcting (in particular at the intermediate and advanced levels) and that, consequently, learners had to be trained to use these digital tools with caution. In their conclusions the authors added that more research was needed to better identify learners’ knowledge of what the tool can provide and how it can be used effectively. They further concluded that learners should learn to critically assess their written work rather than simply edit or correct their text. Similarly, Dejean (2003) conducted a study on collaborative writing by two students of French as a foreign language. In the first phase of the study, the two students were required to write a text together using pen and paper. In the second phase, the same students had to repeat the activity using a computer. Dejean’s study analyzed the interactions between the two

students in both contexts to assess whether the technology had any visible effect on the interactions. Despite the study's limit due to the small number of participants, Dejean observed that the tool (herein also called *artefact*), and more particularly the computer itself, had a role in enhancing formal corrections as well as encouraging a dialogue between the student who wrote and his or her peer. However, the computer played a negative role in that students were too often tempted to erase and rewrite rather than edit. Dejean thus concluded that the artefact was not a neutral element within an activity and that, contrary to what Levy (1997) had proposed in an earlier study, it introduced a new set of interactions and actions, such as when students made decisions as to who would manipulate the technology (in the particular case of Dejean's study, one student would type and the other would use the mouse to navigate in the text).

While these practical aspects of digital writing research are essential in understanding interactions between language learners and technologies, several theories of learning can also guide us in interpreting our observations. Generally speaking, within the theoretical framework of second language acquisition (SLA), the use of technology to engage learners in peer editing has been largely influenced by sociocognitivist and interactionist theories of learning. Sociocognitivists maintain that learning is both a social and cognitive activity: learners are social "actors" who interact with each other by activating their cognitive resources (e.g., Coşereanu, 2009; Narcy-Combes, 2005). Likewise, interactionists perceive verbal or non-verbal exchanges (either synchronously or asynchronously, and either face-to-face or not) between learners as opportunities to acquire language processes (e.g., Chapelle, 2005; Ellis, 1999), namely, by receiving language input and producing language in context. Chapelle (2005) asserted that, "[a]lthough the benefits of the various types of interactions would not be expected to be mutually exclusive, the three types of benefits might be characterized as opportunities for negotiating meaning, obtaining enhanced input, and directing attention to linguistic form" (p. 55). This SLA perspective on interactions will be expanded in the present study in order to examine the quality of the interactions, namely the processes, rather than to evaluate the performance at reaching the outcomes. This broader outlook on interactions is central to the present study since it seeks to better understand how language learners interact with each other (at the linguistic and cognitive levels), while also interacting with online resources.

Research Goals

To better understand what language learners actually do during peer-editing activities (a critical component of L2 writing classes), we set up a case study in an intensive intermediate French class. The overarching goal of the case study was to better understand the (meta)cognitive and functional strategies exhibited by participants engaged in technology-mediated peer-editing activities in which interactions constitute a critical component. For the purpose of the present study, we define *interactions* in the same manner as Chapelle (2005), who explained, "I use the term interaction as the superordinate concept that includes any type of two-way exchanges" (p. 54). Chapelle added, "such exchanges can be enacted through the use of linguistic or non-linguistic means" (p. 54). This point is important for this study since it seeks to explore the interactions between peers as well as the interactions between learners and the digital artefacts that they use.

Two main research questions are addressed in this study:

1. What types of interactions with the tool and between learners occur during a focused session within a lab?
 - a. What types of strategies do learners use in order to interact with each other and with the technologies?
 - b. Do the AR and VSC illustrate specific patterns of interactions?
2. What do the interactions reveal in terms of task design and overall activity of peer editing?

Method

Participants

A total of 12 participants (nine females, three males) were recruited for this case study, in an intensive French course that focuses on the development of writing and grammar skills and is offered in a hybrid delivery format, consisting of 3 hours a week in class and the equivalent of 3 hours of online follow-up exercises. At this level, students have reasonable oral communication skills but still need to work on the grammatical accuracy of their oral and written outputs.

The research goals and procedures were explained to all students during a class presentation by the main researcher and her research assistant. As the activities targeted by the study were part of the program, students were recruited on a voluntary basis to agree to have their interactions recorded. A consent form containing multiple signature points allowed each participant to fully understand every step of the data collection and to participate in all or some of the data collection.

Procedure

The main researcher discussed the experiment with the instructor to ensure that it would be in line with the activities of the course. One component of the course focuses on text editing, and the instructor had decided to set up two sessions of in-class peer-editing activities. During these sessions, students were required to use the online editing tool *BonPatron* (see <http://bonpatron.com>) as well as online French dictionaries or other digital resources of their choice. *BonPatron* is a French grammar and spelling checker that claims to capture about 80% of errors in a text. As stated by the creators of this program:

BonPatron will not catch 100% of errors (nor will the average teacher!). Our own research (and that of an independent review) suggests that *BonPatron* will catch approximately 82% of errors. It is a learning tool that is designed to improve texts, not make them flawless (that's where you, the teacher, come in!). We therefore suggest that *BonPatron* be used for all first drafts and that your writing program include a two-stage correction (1st by *BonPatron*, and then by the teacher). (<http://bonpatron.com/en/Edu/>)

The present case study included two sessions (as per the instructor's original class planning). During the first session, three groups of two students were required to work for 25 minutes¹ in a research lab that is equipped with VSC and AR tools. While students edited their respective texts, we recorded their interactions with the digital tools (VSC) as well as those with each other (AR) using *Camtasia*. In order to minimize the negative influence that working on an unfamiliar platform may have on an activity, we offered participants the choice to use a PC or a Mac computer. Following this first session of text editing, we organized a first debriefing with the instructor to discuss the activity as per our initial observations. Both the instructor and the researcher agreed that 25 minutes did not provide enough time to edit two papers and decided to double the task period for the second session of text editing. In addition, the researcher recommended to the instructor to bring students (who did not partake in the case study) to a classroom equipped with computers so that they could access resources more easily in a space that would facilitate the use of technologies.

During the second session, two groups of three students worked for approximately 50 minutes in the research lab. We recorded the interactions in the same manner as during the first session. A second debriefing with the instructor followed this intervention.

A post-intervention online questionnaire was sent to all participants. This questionnaire collected feedback on students' perception of the activities, tools, and usage of technologies. Out of the 12 participants, only six sent us their feedback.

Data analysis

We collected about 3 hours of AR (3 hours and 18 minutes, based on five group sessions), five VSCs, 1 hour of debriefing (two sessions) and six post-intervention questionnaires. All the AR sessions were first transcribed using a text editor. Two research assistants checked all transcriptions to increase accuracy. The generated transcriptions (forming our "corpus") were imported into the NVivo software in order to be analyzed. We used a qualitative method by creating a coding system inspired by Oxford's taxonomy of direct and indirect learning strategies (Oxford, 1990). This system was applied to the entire corpus. As explained by Besnard (1995), Oxford's taxonomy presents the advantage of being directly related to theories of SLA, hence allowing instructors to devise specific tasks in relation to the strategies that they wish to help their learners develop. We used an inductive procedure to code the data by deriving the categories (coded as strategies) from the text as we anticipated that we would need to create more categories than those included in Oxford's original taxonomy. Using a method proposed by Blythe (2007) to code the data, we first defined our units of analysis according to words, phrases, clauses, T-units, and/or small paragraphs. Some units (termed "*manifest unit*" by Blythe, 2007, p. 215) were easy to code because they clearly reflected a specific strategy such as expressing laughter or humour (affective strategy) or validating a proposition or comment from a peer (social strategy), as illustrated by the following two occurrences: (a) *non, c'est correct, c'est correct* [no, it's correct, it's correct]; (b) *Alright. Je crois que tu avais raison.* [Alright. I think that you were right.]. Other units (termed "*latent unit*" by Blythe, 2007, p. 215) were more difficult to analyze and required that the coder infer the purpose of the statements. In this case, the coding was discussed with another research assistant in order to mitigate the subjectivity inherent to such qualitative analysis. After the first coder had finished analyzing a transcript, discussion with the main researcher helped to increase the reliability

of the coding. Because we were looking for strategies through language, measuring “reliability [was] more difficult because of the degree of interpretation” (Blythe, 2007, p. 215). Once all transcripts were coded in NVivo, we could find trends more easily. Table 1 shows the categories of strategies that were used to code the five ARs:

Table 1

Categories Used to Code the Transcripts From the Audio Recordings (as per Oxford, 1990)

A. Indirect Strategies	1. Affective Strategies	a. (self) encouragement b. laughter/humour
	2. Metacognitive Strategies	a. anticipation b. thinking aloud (verbalization) c. (self) evaluation
	3. Social Strategies	a. requesting help from peer b. asking or answering questions c. validating or offering instructions d. validating comments/propositions from peer
B. Direct Strategies	1. Cognitive Strategies	a. analyzing b. paraphrasing c. suggesting corrections d. contesting corrections e. translating f. reading aloud (of a word or phrase in the learner’s text) g. repeating a word or phrase h. validating online tool propositions i. validating corrections
	2. Functional Strategies	a. commenting on online tools (use and/or functions)
	3. Other Strategies	a. using first language b. questioning or confirming a search

As seen in Figure 1, using NVivo has the advantage of showing the type of language items that are used within each strategy, allowing for further and more refined analysis if desired, in particular, “identifying the commonalities, regularities, or patterns” (Seliger & Shohamy, 1989, p. 205) across the various participants’ data.

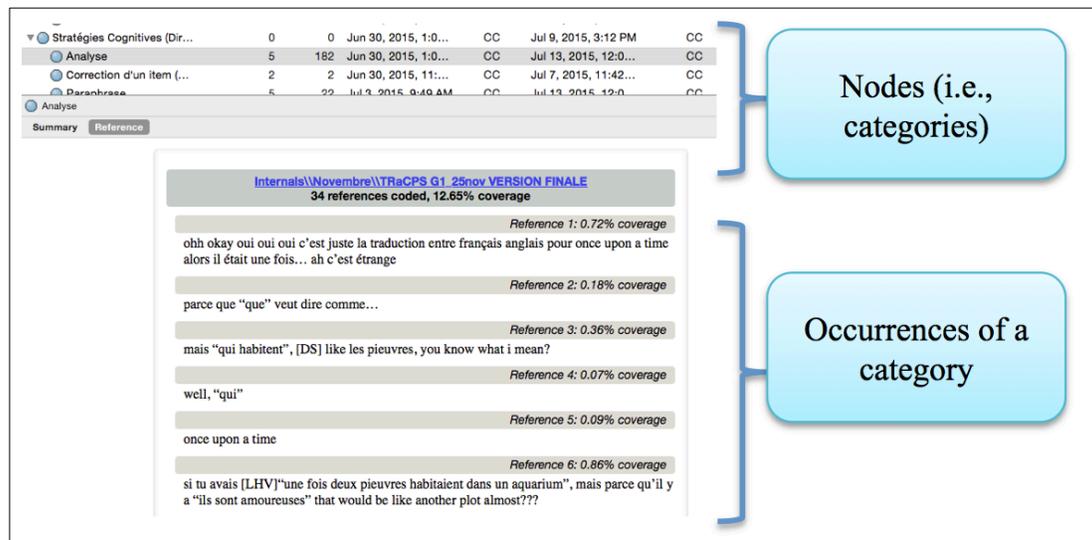


Figure 1. A sample of transcript coded using NVivo. For each category or subcategory, a percentage indicates the coverage within the entire set (in our case a set was a transcript of an audio recording [AR]).

All VSCs were coded manually according to the specific interactive features that participants exhibited during their sessions in the lab. Similar to the analysis of the corpus, which was derived from the transcripts, the coding of VSCs was the result of an inductive method: We consider that every time a user made a visible move (such as typing, selecting a site, scrolling up or down, or moving from one screen/window to another), it created an occurrence of an interaction (OI). Each new OI was labelled using a code in order to count and analyze patterns of interactions and derive trends. Table 2 specifies the codes that were used to analyze the VSCs.

The results of the coding and labeling were put into Excel, as shown in Figure 2. The columns on the left record the number of various categories of OIs; the time stamps allow us to identify each OI within the video; the comments on the right add specific information to describe each OI.

The post-intervention questionnaires were analyzed quantitatively (albeit with an understanding of their limitations considering the small number of respondents) and the debriefings with the instructor were analyzed qualitatively to address issues of task design and questions relating to the context of activities. The comments from the two debriefing sessions were also used as reference when attempting to understand certain interactions, and address specific process or product issues revealed by the VSC.

Results

First, we analyzed the five sessions (AR and VSC) to look for trends regarding the level of interaction of students as well as the efforts to complete the tasks. From the transcripts, we measured the level of efforts by counting the number of words produced (N words), the overall number of turn-takings (N TT), the number of TT (being either a word or a full paragraph) by each participant within the group (N TT/part.), as well as the level of interaction with the technologies (measured in CLs). Table 3 outlines the characteristics of interactions for each group. Groups were named G1 (for group 1), G2, or G3, along with the corresponding month (e.g., G1Oct, and so on).

Table 3

Characteristics of Interactions Within Each Group and for Each Participant

Characteristics	G1Oct	G2Oct	G3Oct	G1Nov	G2Nov
Session time	35:44	25:09	42:30	40:55	45:09
Participants	FM ^b	FM	FM	FFF	FFF
N words	4380	2909	7276	3182	2237
N TT	389	372	503	459	177
N TT/part.	F 192 M 191	F 202 M 170	F 198 M 305	F1 201 F2 184 F3 74	F1 84 F2 88 F3 5
N CL	276	370	318	537	183
N ^a words/ min. (M)	122	116	171	78	52
N ^a words per TT (M)	11	8	14	7	13
N ^a CL per min. (M)	8	15	7	13	4

Note. N = number; TT = turn-takings; N TT/part. = number of turn takings (being either a word or a full paragraph) by each participant within the group; CL = click; G = group.

^aNumbers were rounded to the closest whole number.

^bLetters distinguish gender of participant.

Although the data shown in Table 3 are limited due to the small number of participants, they reveal certain characteristics that are valuable for future research and for task planning. The activity in October was intended to last 25 minutes. However, two groups elected to stay longer. Contrary to the October groups, the two November groups spent less time than expected to edit both papers although the papers were longer and more sophisticated. In addition, we note a sharp contrast in terms of language used during the interactions, with one group (G3Oct) using more than three times more words than another group (G2Nov), hence using more elaborate sentences at each turn-taking. There are many factors explaining these differences (such as competency level, motivation, relationship

between peers, task understanding, or preparedness of participants) that will need to be taken into account for future activity settings. During the first debriefing session with the instructor, we discussed the time allocated to the first peer-editing session (20 minutes) and agreed that it was too short. We doubled it for the second session (50 minutes) but did not formally discuss the complexity of the task. While analyzing the VSCs, it appeared that none of the November groups used one of the tools required, namely the French online dictionary *Le Grand Robert*.

The variations in regard to N TT and N CL (see Table 3) offer some information concerning the interactions between participants, and between participants and the digital tools. We note in particular that G3Oct was the most loquacious group, with a high level of interaction (highest number of TTs), while having a relatively low number of CLs. This could indicate a fairly efficient interaction with the tools. As will be explained later, this group ranked first in using *analyzing* as a strategy. However, we also note that this group shows the widest differences in terms of TTs within the three October sessions (with G1Oct at 192/191, G2Oct at 202/170, and G3Oct at 198/305), meaning that one participant dominated the group. A closer look at the verbal interactions between both participants illustrates that one participant was at a higher level of linguistic proficiency, and thus most of the session was spent editing one text, with the less competent participant writing at the computer, and the most competent participant analyzing the content and commenting at a meta-level.

Likewise, we note a sharp contrast between the two November sessions. G1Nov features more than twice the amount of TTs as well as CLs than G2Nov. While two participants seemed to interact fairly equally, the third one was less active. In G2Nov, there is a clear difference between participants' interactions: Two participants are almost equal, while the third hardly interacts with her peers. A close analysis of the VSC reveals that this group opted to work in a different manner. They exchanged their papers (hard copy) and used the computer to occasionally check a word. Their interactions included asking each other questions of clarification, and *analyzing*. This group is the least verbose with only 52 words per minute. Consequently, several strategies, such as *reading aloud*, *commenting on the tools*, and *requesting help from peer*, which were revealed in the other groups, are almost absent.

Analysis of participants' interactions with the computer (similar to user testing in human-computer interactions research) included detailed observations of the navigation patterns as revealed through the VSC. These can help us assess the efforts produced by the participants, also measuring whether users are interacting efficiently with the technologies, or whether the activity is conducive to an efficient use of the system prescribed. During the first peer-editing sessions (October), participants all used *BonPatron* as required, as well as *WordReference* (see www.wordreference.com). The primary actions consisted in selecting, mouse pointing, erasing, and typing. G1Oct had the most instances of consulting additional online resources, such as using *Wikipedia* to find terms in French, and consulting language user forums and French conjugation sites. This group's VSC showed that the members quickly switched tabs and manoeuvred from one window to the other at a fast pace. Moreover, certain VSCs indicate that participants tended to scroll up and down texts, scanning the content rather than reading. Finally, when reading more attentively, some users used the mouse as a pointer to follow along.

Likewise, both groups in November used the computer to access additional materials, such as grammar and spelling checkers. While G1Nov used *BonPatron*, G2Nov did not use

the online editing tool despite the task instructions. A close look at G2's computer interactions reveals that the participants had multiple tabs opened on their screen, navigating from one section of *WordReference* to another, in addition to using *Google.fr* as an information provider. While G2Nov was the only group in which members did not edit their paper online, it was the only one in which members consulted the course notes in the class *Moodle* site in order to verify grammar rules about past tense.

Regarding users' efficiency in interacting with digital tools, we note that G2Oct and G1Nov have the highest number of CLs per minute, meaning that they may have been putting in more effort (ergonomically speaking) to achieve similar results as their peers, that is, they were less efficient in using digital tools. For instance, a close look at the VSC of G1Nov reveals that these participants had the highest instance of MP (mouse pointing) and that most of this navigation with the mouse resulted in random clicking. Likewise, both G2Oct and G1Nov feature the highest instances of Ers (erasing) and Tp (typing) of letters or words. We can infer that, while other groups would pause, analyze, or reflect, these two groups were constantly interacting with the computer.

Analysis of the coded transcripts revealed specific patterns of discourse in relation to the various strategies we had identified (see Table 1). Within the transcripts, we identified a total of 2391 occurrences (called *references* in NVivo), corresponding to 22 strategies (*nodes* in NVivo), as shown in Table 4. Each group (*source* in NVivo) does not use every strategy identified. In addition, each occurrence can be coded as one or more strategies. For instance, students may ask their peer a question (*questioning or confirming a search*) using their first language (*using L1*) while also asking for help (*requesting help from peer*). In Table 4, the most common strategies are identified in terms of the number of references and sources where they were identified.

The data in Table 4 unveil important information. We note that, out of the 22 strategies that we had identified while coding the transcripts, 16 (72%) strategies emerge in the five group sessions (sources). Conversely, one strategy appears in only two sources and the other five strategies appear in three or four sources. Amongst the 16 strategies that emerge in all transcripts, we note some striking variations in terms of use (while also being cognizant of the fact that a reference often reflects more than one strategy). In order to get a clearer sense of the most common strategies, we examined the distributions, within each group, of strategies identified in more than 100 occurrences. These analyses were used to answer research question 2 (see Discussion).

As shown in Table 5, using L1 is the most common trait identified in the five groups but it can be subsumed as an outlier since several strategies can be identified within one occurrence. Likewise, G2Nov shows a striking difference in terms of strategies compared to the other groups. We note in particular a very low occurrence of *commenting on online tools*, which can be explained by the fact that this group did not work directly online to edit the texts (see above) as per the task requirement; instead the participants worked individually and consulted online reference tools occasionally (such as *WordReference*). Moreover, the low occurrences of *reading aloud* and *requesting help from peer* during G2Nov can be explained by the fact that the members of this group did not work collaboratively on one text at a time.

Table 4
Characteristics of Occurrences and Strategies Identified

Nodes (Name)	Sources (N)	References (N)
Questioning or confirming a search	5	15
Using first language (L1)	5	546
(Self) encouragement	5	23
Laughters	5	99
Analyzing	5	182
Paraphrasing	5	22
Suggesting corrections	5	189
Contesting corrections	5	22
Translating	5	48
Reading aloud (a word or phrase in the text)	5	169
Repeating a word or phrase	4	22
Validating online tool proposition	3	12
Correcting (validating)	3	12
Commenting on online tools (use and/or functions)	5	202
Questioning or validating tool	3	14
Anticipating	5	33
Thinking aloud (verbalization)	5	148
(Self)evaluation	4	17
Requesting help from peer	5	169
Asking or answering questions	5	207
Validating or offering instruction	2	13
Validating a comment (C) or proposition (P) from peer	5	131 (C) 96 (P)

Table 5 suggests other interesting patterns. For instance, with G3Oct (the most loquacious group) we note that *validating a comment*, *commenting on online tools*, *asking or answering questions*, and *analyzing* are common strategies while *suggesting corrections* is less common. These results imply that the participants in the group spent more time discussing the text at a meta-level as we had originally inferred from their VSC. Moreover, G2Oct is the highest user of L1 (covering a total of 27% of all the strategies identified in this group), and has the lowest instances of *analyzing*, but numerous occurrences of *commenting on online tools*. Finally, we note that G1Nov has the highest instances of *suggesting corrections*, *requesting help from peer*, and *thinking aloud* while *analyzing* is not common.

Overall Table 5 shows a substantial amount of variations in terms of strategies. While research tends to show that using cognitive and metacognitive strategies is beneficial for learning, the results of this case study indicate that learners vary greatly in their use of these strategies and that the task design might need to be refocused to enhance and encourage the use of (meta)cognition, while still giving space to socioaffective strategies.

Table 5
Patterns of Most Common Strategies Identified in the Audio Recordings and Video Screen Captures (In Order of Occurrences From Most Common to Least Common)

Strategies	References (total)	G1Oct	G2Oct	G3Oct	G1Nov	G2Nov
Using first language (L1)	546	121	146^a	137	116	<u>26^b</u>
Validating a comment/ proposition from peer	227	60	46	50	42	<u>29</u>
Asking or answering questions	207	47	34	50	45	<u>31</u>
Commenting on online tools (use and/or functions)	202	8	58	79	56	<u>1</u>
Suggesting corrections	189	53	33	<u>18</u>	62	23
Analyzing	182	35	<u>19</u>	64	34	30
Reading aloud	169	63	21	24	55	<u>6</u>
Requesting help from peer	169	40	37	31	53	<u>8</u>
Thinking aloud	148	37	<u>17</u>	24	41	29

^aBold indicates the highest number of occurrences of a strategy identified.

^bUnderline indicates the lowest number of occurrences of a strategy identified.

Discussion

These micro-analyses of peer-editing tasks and interactions with digital tools reveal significant findings in relation to the original research questions. The first set of questions that the present study sought to answer was the following:

1. What types of interactions with the tool and between learners occur during a focused session within a lab?
 - a. What types of strategies do learners use in order to interact with each other and with the technologies?
 - b. Do the AR and VSC illustrate specific patterns of interactions?

Variations in the Form and Pattern of Interactions

Results indicate that interactions from one group to another vary more in terms of interactions with the computer than in terms of interactions between participants. However, there is one variable that needs to be taken into account within the overall task ecosystem: the level of involvement of the researcher during the peer-editing sessions. For instance, the transcript of G3Oct shows that the researcher responsible for the session was more involved in soliciting the participants' cognitive and metacognitive strategies than in other sessions.

As a result, analysis of this particular transcript revealed a higher level of interactions, more TTs, as well as more words per TT and per minute. The two participants in G3Oct were more engaged in the task and more focused on the linguistic items that they were trying to edit. In addition, one of the participants in G3Oct took the lead, showing a higher level of proficiency and overall preparedness. This finding concurs in part with Dejean's (2003) study in that the use of digital artefacts added a dimension to the task that cannot really be neutralized: The student who was responsible for the technology had less opportunity to verbalize and analyze the text. However, this group is a good example of a socioconstructivist environment, namely illustrating the Vygotskian model of zone of proximal development (ZPD, e.g., Vygotsky, 1978); participant 1 required the skill set of participant 2 (who was at a higher level of proficiency) and participant 2 also benefited from the mentoring provided by the researcher who provided some clues to both participants.

Strategies and Patterns of Interactions

Observations and analysis of the various data collected allowed us to distinguish three patterns of interactions:

The first pattern of interaction is characterized by an overreliance on the digital tools. According to this pattern, the participants start by discussing one specific item that they think merit editing. The transcripts show that their intuition is correct and a discussion follows. As none of the participants are certain about the answer, they decide to do an online search. A rapid search on *WordReference* or *Google* forums does not seem to provide them with the required answer, partly due to the fact that they are scrolling up and down at a fast pace, hence missing the key information that they are seeking. The scenario ends with participants deciding to rely on the suggestion proposed by the online editing tool (despite their original intuition that the tool's correction was inaccurate in that particular context). The following from G1Oct illustrates this interaction pattern:

- Well, je pense que ça va* [Well, I think it is correct]
- BonPatron dit c'est bon* [*BonPatron* says it's correct]
- C'est probablement bon* [It's probably correct]
- Si BonPatron c'est bon, c'est bon* [If *BonPatron* (says) it's correct, it's correct]

The second pattern of interaction is characterized by a lack of interactions between peers and/or with the digital resources. Students work in the same space but seem to lack collaborative skills. Rather than working together on a text, members of one group went as far as exchanging their respective paper and correcting them while using the computer as a reference tool. When discussing the task with the instructor during the first debriefing, she made the same observation. In class, most groups of students had exchanged their papers; rather than analyzing together the correction(s) that the online editing tool was proposing to them, they had corrected each other's paper and consulted the digital tools individually as needed. One of the reasons inferred for the behaviour of students during the first in-class session was that the physical environment was not conducive to collaborating and interacting with each other and with the technology: Students were gathered around small tables attached to chairs where there was little room for the tools. By contrast, when the second in-class session was moved to a room equipped with computers and larger tables,

students became much more active as observed by the instructor during the second debriefing.

Taking a sociocultural perspective, we can infer that the groups did not fully partake in the interactive nature of the activity. They had not yet internalized the process of peer editing and exploiting digital resources, either because they had not appropriated some of the tools' functions or because they had not been repeatedly exposed to some of the artefacts used during previous activities. Evoking the concept of mediation, Lantolf and Thorne (2008) explained, "an artifact's materiality is conventional and takes its functional form from its histories of use in and across cultural practices" (p. 80).

In contrast to the second pattern of interaction, the third pattern is characterized by extensive discussions and meta-analysis of linguistic items. Participants collaborate toward a common goal of editing their respective paper, working on one paper at a time. After submitting their paper to the online editing tool *BonPatron*, they continued their revision by resorting to their intuition. Discussions, analysis, and questioning unfold, and a fairly extensive and dynamic interaction with digital tools enhances the product and the learning process. *Validating a comment or a proposition, asking or answering questions, and commenting on online tools* are strategies that are commonly observed in these groups. Validating each other's propositions is done in a very expressive manner using repetitions and exclamations, as shown in the extracts below:

- Oh oh oh oh oh oui oui oui oui oui* [Oh . . . yes . . .]
- Yeah. Go with that.
- Alright. Je crois que tu avais raison. Hummm . . .* [Alright. I think that you were right. Hummm]
- Ok, oui, yeah!* [Ok, yes, yeah]
- Non c'est correct, c'est correct!* [No, it's correct, it's correct]
- Ahhh!
- Ah yeah oui oui ok!* [Ah yeah yes yes ok]
- Oh ouais juste comme ça . . . Ah ça fonctionne . . .* [Oh yeah just like that... Ah, it works]
- Ah yeah. Hum. Hummm, yeah!

In the third pattern of interaction, participants also question each other about the digital tools and/or about the activities requirement, as shown in the following samples. We also note a typical mix of English and French in the dialogue (common to all groups observed in the present study):

- Oh control F, *est-ce que ça fonctionne ici? Euh où est le . . .* I use OpenOffice where's the remove formatting? [Oh control F, does it work here? Where is the . . . I use OpenOffice, where's the remove formatting?]
- You go directly to this and you select all the text, uh, you copy and you paste it usually I was going to try doing it below. OK [H]uh. Ok then I'd go—if you paste it usually there's this thing and if you click on this: keep text only. And it just does that.

Reflections on the Activity

The present study intended to correlate observations of interactions with the activity, namely its design. Our second question was the following:

2. What do the interactions reveal in terms of task design and overall activity of peer editing?

To answer the second question, we contrasted our analysis of learners' data to the instructor's perception of the task and her observations of learners involved in a similar task in class. We also analyzed the feedback that participants provided after the intervention. Three main findings emerged from the study.

The first finding is that time is a key component in designing such a collaborative task. Time may enhance or drastically impair the success of the task by limiting learners' opportunity to reach the desired outcomes. Time was discussed during the first debriefing with the instructor, hence the change in the second peer-editing session. Related to the issue of time, feedback from both the instructor and participants—who compared their experience with the in-class sessions—suggests that the activity is more effective when done outside of class (similar to what was organized in the research lab) in small groups, with no time constraint. The following comment illustrates in part this finding: “The session at the research lab is more *personal* and it is *easier* to *concentrate* on the paper and *communicate* to my peer” (part. 6933, emphasis added).

The second finding is that training on how to learn in technology-mediated environments needs to be more formally provided to learners. While systematic training can help users benefit from the wealth of information that is available online, it is mostly needed to create interactions that are more critically informed and to avoid the overreliance on what the technology suggests. Selber (2004) proposed a multi-parameter framework to develop functional literacy, hence encouraging “productive and efficient computer use” (p. 72). He further explained: “[t]he knowledge, skills, and attitudes that students need cannot be derived from ad hoc approaches or approaches that disregard the fact that computer literacy is dynamic and varies with context” (p. 72). Overall, this need for systematic and specific training, set within strict and well-defined educational contexts, corroborates previous studies showing that digital skills used for personal communication did not transfer automatically into digital skills for learning (e.g., Caws, 2013; Hamel, 2012; Hamel & Caws, 2010).

The third finding is that activities of peer editing that include time and room for dialogue have the potential for exploiting metacognitive knowledge. When participants were asked to reflect on the peer-editing sessions set in the lab, several mentioned the interactions as a positive tool:

For peer editing, I like being able to discuss the text and talk about my rationale behind my word choice and asking questions about their suggestions or their work as well. *I find it much more helpful to have the interaction as I feel I learn much better that way.* (part. 7488, emphasis added)

It was fairly successful. I was paired with a student who had more trouble with French grammar than I do, so we spent essentially the entire session working on his project. (part. 8968)

Moreover, the strategies that were observed during the sessions seem to suggest that some participants showed and expressed an understanding that literacy is connected to social interactions in various ways. This finding aligns with the concept of affinity-based learning, placing learners in situations to which they are accustomed based on their regular social interactions online in their private space (e.g., Gee & Hayes, 2011).

Conclusion

As the present study illustrates, micro-analyses of interactions in language-learning settings can yield fruitful results. Close observations of learning processes help researchers to better understand students' language needs, as well as the culture of learning in which they live. As Blythe (2007) explained, data coding of texts (in our case transcripts of ARs) is a worthy research enterprise because "texts . . . reveal important characteristics of culture and human behaviour" (p. 221) even if they are open to interpretation. By combining the analysis of AR transcripts (i.e., the product) with the analysis of VSCs (i.e., the process), this study could infer as to why learners made specific choices as well as to how their interactions with technologies may have influenced (rightly or wrongly) their choices of language and overall communicative skills in the L2.

This case study also presents implications to task design and learners' role within the educational context. Citing Sullivan and Porter (1997), Blythe (2007) explained that *critical research* "begins and ends with a commitment to research participants" (p. 223). Such commitment enhances participants' role and values the need to perform research with a view to ultimately ameliorate participants' conditions or situations. Comparing critical research to action research, Blythe added, "[g]iven that critical research begins with a commitment to others, its focus is directed toward action rather than observation. Critical research is about working with others in order to improve real conditions" (p. 224). The present study followed this principal because it focused exclusively on participants during regular class activities to pay a particular and detailed attention to their context of learning. In addition to observing learners, this case study also focused on the instructor in order to help reflect on the peer-editing activity, in terms of its relevance to learners, its overall design, and the physical conditions under which it should be set up to facilitate its outcomes. Consequently, the results of this study can be translated into specific changes within the task design in order to address the shortcomings that participants seem to encounter (in particular with regard to time on tasks, overreliance on digital tools, lack of analysis of findings with online tools, and need for increased focus on metacognitive skills development).

As the present study suggests, an assessment focused on one specific aspect of a learning environment yields results that have implications at both the theoretical and practical levels. From a theoretical standpoint, it emphasizes the requirement to consider learner-computer interactions as complex mediations embedded in sociocultural perspectives as much as interactionist perspectives (e.g., Lantolf & Thorne, 2008; Schulze & Scholz, 2016; Warschauer, 2005). On a practical level, this study stresses the need to re-envision activities and/or tasks as mechanisms to enhance language proficiency as well as

to develop professional skills, such as digital literacy skills. In sum, as previously highlighted by Felix (2005), research on technology-mediated learning environments needs systematic syntheses of findings related to one particular variable because “the ever pursued question of the impact of ICT on learning remains unanswerable in a clear cause and effect sense” (p. 16). The most obvious reason to pursue our observations of learning processes is best expressed by Felix (2005) in her concluding remarks on CALL effectiveness research:

The most obvious reason, though, is that in an environment where computers have become a natural part of the educational experience and in which we have learnt that teachers will not be replaced by them, the question [of whether teaching with computers was better than teaching without them] is no longer as interesting. What remains interesting to investigate is how technologies are impacting learning processes and as a consequence might improve learning outcomes. (p. 16)

With this perspective in mind, the present study prompts further research. In a future intervention focused on peer editing, participants could be selected more rigorously according to learning styles (clearly documented and tested) and previous experience with technology-mediated language learning. In addition, writing activities could differ, allowing each participant to experience the various treatments and to comment on them through thinking aloud protocols. In addition, while the lab setup of the present study allowed us to record every interaction, it might not yield the same results as a more natural learning context centred on the student. Potential mechanisms to address this weakness would be to replace the recording of sessions by natural observations and focus on the development of a few specific strategies. Thus, the results produced by the present study will be recycled into future interventions centred on the learner, and further data will be collected to enhance comprehension of learning processes in CALL settings.

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Notes

¹Two groups opted to stay longer in order to complete the tasks.

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