Higher Education Quality Council of Ontario

An agency of the Government of Ontario

Writers in Action: Modelling and Scaffolding Second-Language Learners' Writing Process

Marie-Josée Hamel and Jérémie Séror, University of Ottawa, in collaboration with Chantal Dion, Carleton University

Published by

The Higher Education Quality Council of Ontario

1 Yonge Street, Suite 2402
Toronto, ON Canada, M5E 1E5

Phone: 416 212-3893
Fax: 416 212-3899
Web: www.heqco.ca
E-mail: info@heqco.ca

Cite this publication in the following format:

Hamel, M.-J., Séror, J., & Dion, C. (2015). *Writers in Action: Modelling and Scaffolding Second-Language Learners' Writing Process*. Toronto: Higher Education Quality Council of Ontario.

Higher Education Quality Council of Ontario
An agency of the Government of Ontario

Table of Contents

List of Tables

List of Figures

Executive Summary

The purpose of our research project was to assess the relevance and value added of using a specific technology – video screen capture (VSC) – for instructional purposes in university-level second-language writing courses. VSC technology makes it possible to "trace" all activities visible on a computer screen. Our objective was to understand how VSC, which helps visualize the process of writing on computers, can support this process and enhance students' autonomy as second-language writers.

Our research questions were as follows:

1. What conditions are conducive to integrating VSC in second-language writing courses?
2. What options are available to the instructor and students in terms of instructional assignments that use VSC as a tool to foster the transfer of key concepts associated with the writing process?
3. What advantages are there to using VSC in a second-language writing course, in particular with respect to the development of
    - critical thinking and its impact on the writing process?
    - language proficiency (writing)?
    - language autonomy?
4. As an instructional approach, what value added does VSC have for the instructor?

Our research relied on the latest technological innovations to analyze interactions in computer-assisted language learning situations (Fisher, 2007; Hamel, 2013a; Chun, 2013). These innovations make it possible to produce objective, detailed descriptions of the behaviours observed in students working on computers, descriptions that are collected in a more authentic and organic manner than was previously possible.

In two case studies, we explored how the affordances[1] of VSC were used by two instructors in two university-level second-language writing courses (one FSL course at Carleton University and one ESL course at the University of Ottawa). Their students completed writing assignments using VSC for one term. We gathered the students' opinions on the usability (Hamel, 2012) of VSC through a questionnaire, and we collected the instructors' opinions in semi-structured interviews. We developed a taxonomy of observables to analyze the VSCs produced by the students. These observables included students' actions and verbalizations during computer-mediated writing tasks.

The results of our data analysis (quantitative, qualitative and combined) show that during the writing process, students utilize multiple and varied functional strategies (in their visible behaviours) and metacognitive strategies (in their audible behaviours). In particular, they focus on form (especially lexical), consult language resources to improve their texts, read aloud as they write or revise, and evaluate their performance. Thus, they are engaged, mindful writers. An analysis of their writing journals corroborates these findings. VSC has proven to be a technological tool with multiple affordances for second-language (L2) writing courses, as noted by the instructors in particular. It can provide a pedagogical trace of the students'

[1] Affordance: the capacity of an environment to suggest an appropriate action for the situation; the capacity of an object to suggest how it might be used.

work that displays, describes and explains the writing process. It develops students' introspective capacity in their writing and fosters student-instructor dialogue that encourages "deep thinking." It also allows instructors to provide their students with personalized multimodal feedback on expert and novice writing process models.

We developed recommendations for the optimal use of VSC in a teaching and learning context (second language learning). Our recommendations address instructor training and support through technology, the perspective that instructors and students should adopt on this technology, the transformative and innovative effects that VSC technology will have on the curriculum, and the time and location factors redefined by this technology. In general, the instructors and students enjoyed their VSC experience. They suggested applications beyond L2 writing courses.

Our research showed that VSC is a technology that is relevant and adds value to L2 writing courses. It led to a discussion of the importance of promoting metacognitive thinking in learners (Vandergrift & Goh, 2012) and of finding ways to model the thought processes, practices and decisions that are central to the literacy practices that we are attempting to develop in *writers in action.*

This research is nevertheless a case study whose scope and duration are bounded, and whose findings are necessarily limited in terms of their generalizability. However, the wealth of empirical data collected during the case study offers valuable insight into the writing process and the associated teaching and learning activities. Of course, further research is recommended to better understand the potential of technologies, such as VSC, that provide a way of studying and promoting a dynamic and concerted approach to the development of language skills and writing processes that are at the heart of postsecondary instructional activities.

Acknowledgements

This research would not have been possible without the two instructors who obtained the VSC technology for teaching purposes in their second-language writing courses. We would also like to mention the valuable contribution of their students, who agreed to share the data produced in their writing courses with the instructors. We are sincerely grateful to them.

We also wish to thank the research assistants who helped conduct this research project, which was funded by the Higher Education Quality Council of Ontario (HEQCO): Élisa Cohen, Jessica Chang, Kaitlin Fleming and Julien Duval, all bachelor of education students specializing in second-language teaching; Jessica Durepos and Mélissa-Sophie Pesant, master's students in bilingualism studies and education; Reza Farzi, doctoral student in translation; Isabelle LeCoin, a doctoral intern from the Université du Québec en Outaouais; and Karine Nault, a postdoctoral student in psychology. The experience was deeply rewarding for them.

The Research Team

Marie-Josée Hamel, the primary investigator on this study, has a background in theoretical linguistics and language engineering. She holds a university research chair in new technologies and has conducted research for the past 20 years in the field of computer-assisted language learning (CALL) at the postsecondary level. Her research centres on the design, development and evaluation of ergonomic CALL interfaces. She is particularly interested in examining the quality of the relationship between learners and these interfaces (resources, environments and online learning tools) in language task processes. She has received sizeable research grants, supervised many projects and published many articles in the CALL field. Her expertise was utilized in managing the project, developing the evaluation process, adapting the methodology, training the assistants, analyzing the data (particularly the VSCs and the questionnaires) and disseminating the findings (through reports, articles and presentations).

Co-researcher Jérémie Séror has a background in applied linguistics. He has over 20 years of experience in second-language teaching. His research centres on the social dimension of the development of academic literacies and on the academic and social integration of multilingual students. He is also interested in the advancement of knowledge in the field of advanced bilingualism and approaches that combine language instruction with the teaching of an academic subject. His latest research projects and scholarly articles concern the language socialization of second-language learners in university immersion programs and the contribution of digital technology to the teaching and learning of second-language writing skills. His expertise was utilized in conceptualizing the study, collecting and analyzing data, training the assistants and disseminating the findings.

Collaborator Chantal Dion has a background in education. She has been a French-as-a-second-language instructor since 1985. She advocates for the development of learners' cognitive, metacognitive and critical thinking skills to help them master second-language writing skills. These skills are practised through the autonomous learning approach, with journal keeping, learning engines and storage sites. Mrs. Dion is working on a tool that provides an interface between stimulated critical thought entered in a journal and decisions made to achieve the desired writing proficiency, as both process and product. The project enlisted her expertise in developing experiments, delivering the course, collecting data (non-VSC), analyzing data (particularly the writing journals) and helping to disseminate findings.

Introduction

Project summary and objectives

When students enter university, they must learn to present their ideas and knowledge in written texts, which make up a major component of their evaluation. However, learning to write is not easy. Researchers and instructors point to this skill as a major stumbling block for many students, especially in a plurilingual and pluricultural society like Canada, where increasing numbers of students must learn to write in a language that is not their mother tongue (Early, 2008; Escorcia & Fenouillet, 2011; Matsuda, 2003; Ricento & Cervatiuc, 2009).

This report focuses on this challenge and the vital work performed by instructors who deliver second-language (L2) writing courses. To better understand which instructional tools and techniques are most conducive to fostering the development of L2 writing skills in a university setting, this research project examines a specific new digital technology: video screen capture (VSC). The software application produces audiovisual recordings of users interacting with a computer. Two case studies explore the nature of this technology and its use in two university writing courses. The report looks at how the technology is perceived by the instructors and their students and how it can be used to modify and rethink the task of providing guidance and support for the teaching of writing skills in university.

Relevance of the Research – Literature review

Research on writing skill development

At present, the development of L2 writing skills is an important focus of second-language teaching research (Matsuda, 2013). This interest reflects the plurilingual and pluricultural nature of modern society and the important role that writing plays in academic and social success (Gerbault, 2010). With a view to ensuring that all learners, whether they are native speakers or not, have the potential for success, this interdisciplinary field of research aims to identify instructional principles and techniques that can facilitate the teaching and acquisition of the knowledge needed to write in a second or foreign language (Barbier & Spinelli-Jullien, 2009).

Research on the development of L2 writing skills has been based on a variety of perspectives and methodological approaches (Barbier & Spinelli-Jullien, *op. cit.*). Studies have explored the linguistic and social dimensions of written texts (Hyland, 2000; Ravelli & Ellis, 2004) and the importance of personal qualities, the writers' origins and the circumstances surrounding the act of writing (Casanave, 2002; Spack, 2004). Other studies have examined the role of the feedback provided to writers (Ferris, Brown, Liu, Eugenia & Stine, 2011; Séror, 2009).

Metacognition and second-language writing

One important avenue of research in the development of writing skills in L2 students has focused on the link between metacognitive knowledge and writing performance (Escorcia & Fenouillet, 2011). The importance of this connection was noted in particular for L2 students who had neither the academic training nor the years of experience and familiarity with a language needed to intuitively deduce the norms and conventions associated with writing in the language. The educational objective of this approach is to help students become more mindful and gain explicit awareness of the decisions, actions and resources involved in producing a written text that a reader will accept as satisfactory. This metacognitive awareness enables students to fine-tune and develop their writing skills and, consequently, the quality of their texts (Negretti & Kuteeva, 2011). With this awareness, they can also gain better control of their learning process and increase their motivation (Vandergrift & Goh, 2012).

Hence, there is growing interest in methods for supporting students in targeted reflection and exploration of what writing represents in order to improve their metacognition and self-regulation as writers (Hacker, Dunlosky & Graesser, 2009). Despite this interest, this approach is faced with a challenge: the difficulty in accessing writing strategies and writing-related processes after the fact. Detailed descriptions of what happens when a writer drafts an L2 text (students' knowledge and actions) are scarce (Leki, Cumming & Silva, 2008; Leon & Pigg, 2011). This scarcity is due in part to the difficulty and complexity of the documentation work involved in capturing – authentically and in real time – the vast array of actions and sequences of steps involved in writing a text. These multiple, complex actions often occur outside the classroom and over several work sessions. Unlike an oral communication course, in which the classroom provides a setting where the students can immediately apply the knowledge they have acquired, the more individual, lengthy and labour-intensive nature of the writing process means that students write most of their texts outside class on their own in quiet surroundings. The processes they use therefore remain largely invisible and are not observed by the instructor, who normally has access only to the final product – the written text – and must deduce rather than observe first-hand the processes and strategies used to generate it.

Some researchers have tried to fill this gap in our understanding by using verbalization protocols (Chon, 2009; Thumb, 2004; Varantola, 2002). This method requires writers to verbalize their thoughts either while writing a text or shortly thereafter. Although this method has produced advances in the theorization of L2 writing processes, critics have pointed out its unwelcome effects on the behaviour of the writers being tested. Since the typical writer does not verbalize his or her actions under normal circumstances, the impact that this approach has on the writer's behaviour and the ensuing lack of authenticity are a concern (Abdel Latif, 2009).

Digital technology + metacognition = an interesting opportunity

While few studies performed to date have been based exclusively on direct observation of student behaviour in a specific writing-task context, new technological advances have recently opened the door to new means of evaluating the learning writers' behaviour. These technologies are a direct outcome of the digital revolution that has transformed the act of writing, as a growing number of students interact, compose and work on texts on a computer or tablet, rather than in analogue mode (pen and paper) (Gerbault, 2010). This revolution (Lunsford, 2006; Stapleton & Radia, 2009) has important implications for

the nature of the literacies that these students are developing (many young writers are now more comfortable with a keyboard than with a pen) and for the methods used to teach languages and language skills (some schools no longer teach cursive writing).

To gain a clearer understanding of the consequences of this evolution, researchers have started capitalizing on the affordances of digital writing tools: the computer and its ability to record actions, activities and events almost automatically as the user and the tool interact. The goal is to use the computer to create and record a digital trail of the students' behaviour so that they can be tracked, step by step, as they perform tasks in a digital environment.

Various techniques have been used to help establish and revisit the trail of actions left by students in the process of writing on their computers (Barbier & Spinelli-Jullien, 2009). Researchers used an application that records (a) the student's keystrokes on the keyboard (Miller, Lindgren & Sullivan, 2008); (b) the student's eye movements (Wengelin et al., 2009) and the events and sounds occurring on the screen (video capture) (Degenhardt, 2006; Geisler & Slattery, 2007; Hamel & Caws, 2010; Hamel, 2012; Park & Kinginger, 2010; Séror, 2013). Each of these technologies can be used alone or in combination (Leijten, 2013). However, video capture technology has recently elicited the most interest within the teaching community as a means of strengthening the effectiveness of traditional approaches (Smith & Smith, 2012).

Definition of video screen capture (VSC)

Video screen capture is a specialized software application used to record and save for future viewing an audiovisual trail (image or video) of the specific actions that are visible and audible as a person interacts with a screen in a digital environment. A typical example of an audiovisual trail that such applications can produce is YouTube videos that model, step by step, how a user performs a specific task on the computer. VSC has the advantage of generating objective data on student behaviour in real time, and of significantly reducing the risk of interfering with their natural process, compared with the verbalization method (Fisher, 2007). Researchers are therefore no longer limited to comments or inferences about the process followed in performing a task. For researchers or instructors interested in the writing process, VSC provides access to the behaviours of writers "in action" in a more authentic and organic way, while taking advantage of the impressive wealth of details generated by a visual trail of the learner's behaviour. The data gathered have the advantage of being readily usable in quantitative analysis (counting actions) and qualitative analysis (process reconstruction) of the steps and events observed along the path that writers follow (Hamel, 2012; Hamel, 2013a; Séror, 2013). For example, the duration, frequency and location of pauses while writing a text (Van Waes & Schellens, 2003), the flow of words written at different stages of the writer's process (Spelman Miller, 2005) and access to outside resources, such as online dictionaries (Hamel, 2012), are visible indicators now available through these data.

The technique of directly observing writer behaviour using VSC is enhanced when combined with other approaches, such as journal keeping (Varantola, 2002) and interviews with the writers. VSC sheds new light on the close connection between mastery of the composition process (planning, formulation and revision) and the quality of the texts that students produce (Flower & Hayes, 1981; Raimes, 1985).

VSC and its potential for (language) instructors

In the world of education, VSC is gradually gaining recognition among instructors and instructors interested in incorporating a digital dimension into their lessons, especially in flipped classrooms (O'Flaherty & Phillips, 2015) and hybrid courses (LeCoin & Hamel, 2014). This technology is beginning to make inroads as a means of offering students livelier, more accessible content outside the classroom (Smith & Smith, 2012).

Indeed, a growing number of instructors are trying to integrate these tools in order to provide scaffolding for their students' learning. Writing instructors in particular should take note that researchers are not the only ones who stand to benefit from a detailed visualization of the decision-making processes involved in writing. VSC is a tool for better understanding and reflecting on the multiple processes and strategies central to the act of writing. That said, the tool's instructional applications remain in the early stages, and few detailed reports currently exist on its uses for primarily instructional purposes (exceptions to this include Park & Kinginger, 2010; Séror, 2012; Thompson & Lee, 2012).

Our research is intended to fill this gap by conducting case studies on the adoption of this tool to teach L2 writing to a growing population of learners who are not native speakers in college and university.

Objective

The research project was designed to identify the affordances and best practices associated with an innovative technological tool (VSC) for teaching and nurturing writing skills in postsecondary students enrolled in language programs. More specifically, we wanted to explore the role that this tool can play in increasing L2 students' autonomy and proficiency in the writing process.

Our objective was to assess the tool's relevance in authentic situations and gather the opinions of the people most affected by this type of educational initiative: the students and instructors who have to work with the technology.

Finally, we were also interested in clarifying, on the basis of these opinions, the costs and risks associated with integrating the technology into the curriculum of a writing course. We are therefore confident that our research report will provide a better understanding of the applications of this technology and the specific activities and strategies that it can facilitate in an L2 writing course.

Research Questions

It is important to note that the main goal of our research is not to scientifically prove the effectiveness of VSC software in general, but rather to identify its advantages and limitations when used in a language course. The data collected in this research are used to answer the following questions:

1. What conditions are conducive to integrating VSC in second-language writing courses?
2. What options are available to the instructor and students in terms of instructional assignments that use VSC as a tool to foster the transfer of key concepts associated with the writing process?

3. What advantages are there to using VSC in a second-language writing course, in particular with respect to the development of
    - critical thinking and its impact on the writing process?
    - language proficiency (writing)?
    - language autonomy?
4. As an instructional approach, what value added does VSC have for the instructor?

Research Design and Methodology

Theoretical framework

Our research project aligns with two major theoretical currents:

1. First, socio-cultural theories of learning (Lantolf, 2006; Vygotsky, 1978), which focus on how VSC mediates the understanding and development of the students' writing process (Flower & Hayes, 1981; Hayes, 2000; Hayes & Flower, 1980), the students' metacognitive awareness (Hacker, Dunlosky & Graesser, 2009) and their learning autonomy (Little, 2007; Benson, 2001; Dion, 2011).

2. Second, design approaches for language learning devices mediated by ergonomics-based technologies (Raby, 2005; Bertin & Gravé, 2010; Hamel, 2012), which focus on the quality of "learner-task-tool" interactions on the computer, mediation with the task and computerized tools, and identification of learners' choices and pathways (optimal, efficient, etc.) when they use second-language writing tools (dictionaries, translators, grammar checkers, etc.).

Inspired by the growing interest in "the study of human-machine interaction" (Desmet & Mompean, 2010), our research relied on the latest technological innovations to analyze interface ergonomics, dynamic digital traces and the interaction processes at work in technology-mediated language learning situations (Degenhardt, 2006; Fisher, 2007; Hamel & Caws, 2010; Chun, 2013).

Methodology

We adopted a case study approach (Duff, 2008) in order to conduct an in-depth and detailed analysis (quantitative, qualitative and combined) of empirical data generated by the interaction of instructors and their students with VSC in authentic L2 writing class situations, and their perception of the value added of this new technology in these situations. The effectiveness and depth of the analysis of the interactional data depended on multiple sources (Felix, 2005; Huh & Hu, 2005; Hamel, 2013b). To maximize the precision and comprehensiveness of the results, the comments gathered from instructors and students were triangulated with documents created in class (in particular the FSL students' writing journals specifically about VSC) and the VSCs in order to validate the subjective judgements expressed in the interviews and questionnaires.

In this study, to collect data from the instructors, we included an overview of the writing assignments, a semi-structured, post-intervention interview, and observations of co-researchers before and during the intervention. We collected data from the students by analyzing the VSCs they created, their responses to the post-intervention questionnaire and their writing journals (FSL group). We suggest that these empirical data

should be draw from natural, non-experimental conditions, including the fact that the writing assignments using VSC were designed by the instructors themselves and not by the researchers. The language instructors were therefore trained to use VSC prior to the study intervention.

Preparations for the intervention

Training workshops

The VSC technology was initially presented to L2 instructors during several workshops and information and training sessions. The two co-researchers organized and led these workshops, which were offered on three occasions at the Official Languages and Bilingualism Institute to all interested full-time and part-time language instructors. The workshops included a detailed demonstration of a specific tool used to produce VSCs: Screencast-O-Matic.com.

Screencast-O-Matic (SOM) was specifically chosen because of its reliability and user-friendliness. SOM is a free application that operates in a Web browser on any computer. It does not require the purchase or installation of special software and is an easily accessible resource for students and instructors (especially because VSCs can be made anywhere the student is working – in a lab, at home or even at a friend's place). Once a recording is finished, users can save their VSC to a hard drive or upload it to a server. The recording can then be used to share the VSC with other students in the class or with the instructor. The free version of the program can create VSCs of up to 15 minutes in length. A professional version, available by monthly subscription, can create VSCs of unlimited length.

The workshops served to familiarize instructors with the potential of VSC and to create a group of instructors interested in the technology and its applications in an L2 writing course. The workshops' objective was to work with the instructors to develop models of writing activities and sequences of writing activities for implementing VSC. Each workshop provided concrete examples of computer writing tasks involving VSC to help students improve their L2 writing skills and help instructors scaffold the process more effectively. In each workshop, instructors were given hand-outs to help them pursue their investigation of VSC and its potential applications in language courses.

Recruitment of the instructors

Following the training workshops, two instructors in particular expressed interest in including VSC in their writing courses: one English instructor (University of Ottawa) and one FSL instructor (Carleton University), who was also a collaborator on our project. Both were experienced, with 30 and 10 years of experience, respectively, in teaching university-level L2 courses, particularly writing courses. Their profiles are provided in the analysis below, along with their reasons for introducing this new technology in their courses. They agreed to revise their course plan to accommodate VSC technology and, in particular, to design writing assignments that would use it. The results of the design work by the two instructors in the summer prior to the classroom intervention are also described below.

Context of the intervention

Description of courses and participants

The two instructors we recruited decided to integrate VSC into a university half-course in French and English as a second language, respectively, at the advanced intermediate level (B2), focusing on writing. Study participants included each instructor's students who agreed to complete a questionnaire about their experience with VSC and allow the work they produced during the course (texts, VSCs and writing journals) to be used for research purposes. A total of 36 students agreed to participate in the experiment (18 in each class). The table below provides contextual information on the intervention (profile of participants and courses).

Table 1: Context of the Intervention (profile of participants and courses)

FSL course at Carleton University	ESL course at the University of Ottawa
FSL writing (3 hrs/wk)	Writing component of an intensive English course (3 hrs/wk)
18 Anglophone students (third-year undergraduate, non-major) / 25 registered in all	18 foreign students (pre-university course, prerequisite for admission) / 22 registered in all
Level B2 (CEFR), writing	Level B2 (CEFR), writing
Course designed to develop academic and professional FSL literacy	Course designed to develop academic ESL literacy
Production of various texts	Production of university-level essays
5 writing assignments using VSC performed at home	5 writing assignments using VSC performed in the language lab
Writing assignments to be completed individually using VSC	Writing assignments to be completed individually using VSC, and one group assignment

Description of the Intervention

The classroom intervention took place in the Fall 2012 term (September to December). The co-researchers were not present in class and did not observe the instruction. However, they were available (by email or in person) to monitor progress, support the instructors as needed and document their experiences. The two FSL and ESL writing courses ran for 13 weeks, during which students performed writing assignments with and without VSC. As planned by each instructor, five assignments were completed in each class with VSC, i.e., using the software presented in the workshops: Screencast-O-Matic. The two instructors chose to use the free version of the software.

In the ESL class, the students created VSCs either individually or in teams of two or three, using language lab computers. They also created an online VSC library as the course went along. Once during the term, the instructor gave

the students individual feedback after analyzing their VSCs. However, the VSCs were regularly reviewed in class (shared or not with peers). The students were also encouraged to view their VSCs on their own and reflect on their writing process. Lastly, the instructor used VSC in class to demonstrate a model of an expert writer's writing process.

In the FSL class, the students created their VSCs using their own computers at home at a time of their choosing (based on the schedule set by the instructor; they had an average of two weeks to complete a writing assignment using VSC). The students also created an online VSC library as the course went along. The instructor viewed all of the students' VSCs and, at the same time, read their writing journal entries. She gave written feedback on the texts and discussed the results observed in class. For one writing assignment, the instructor used VSC to provide individual feedback to each student on his or her text. Students' VSCs were not shared in class or with peers. As in the ESL course, the FSL students were asked to review their VSCs on their own and to reflect on the writing process.

At the end of the term, the students in each class were asked to download their VSC library to a USB key. A research assistant gathered all of the keys and kept only those from students who had signed the consent form giving permission to use their data; the others were destroyed. The students were also asked to complete an online questionnaire provided to them two weeks before the term ended (after the last writing assignment) and before the final exam. Only the questionnaires submitted by students who signed the consent form were compiled. For ethical reasons, the instructors were not informed which students had agreed or declined to participate in the study before they submitted the final grades. At the end of the term, once the grades were finalized, students who had agreed to participate in the activity were identified. Their identity was retained, but their data were rendered anonymous.

The two co-researchers held a semi-structured interview with each instructor at the start of the second term, once exams had been corrected and grades entered.

Research tools and analytical approach

General description

As mentioned above, we wanted to take a mixed analysis approach to combine the various types of data gathered, using an iterative procedure for sorting, coding and organizing the data. Guided by the research questions, this analysis is intended to summarize the key elements identified in each data category before triangulating them to determine the activities at which students were most successful and to identify the affordances of VSC, as perceived subjectively by the participants (interviews and questionnaires) and objectively (documents and VSCs collected).

VSCs

The VSCs created by the students were coded using a special application (Morae) that inserts various types of markers in the VSCs (e.g., "highlights a segment of the text," "reads out loud") and counts them. This process identifies the steps taken and decisions made in real time, i.e., from the start to the end of the writing assignment. The technique is based on interface ergonomics research (Nogier, 2008) and on current research (Hamel, *op. cit.*; Séror, *op. cit.*). The analytical method entailed identifying specific markers in relation to "observable" actions on the computer screen (Kovacs, 2004, p. 60). These markers correspond to participants' visible and audible actions in the process of writing on the computer (e.g., a text revision task). It was thus possible to identify the actions involved in the writing process (e.g., "consult an outside resource," like a dictionary) and observe each action's impact on rewriting the text ("work on your text"). These parameters were identified, classified and counted (descriptive statistics), and trends were noted. This innovative, VSC-based analytical approach has the advantage of providing an objective, detailed description of the actions performed by students on the computer screen during the writing process. This

work is extremely time-consuming, and as the section on findings shows, we focused our efforts on annotating VSCs produced by students in only one of the two groups included in our study, the FSL group. In all, approximately 4,500 annotations were added to the VSCs.

Questionnaire

A questionnaire was developed using Survey Monkey and made available to students online to help them perform a critical and introspective review of their experience using VSC in the L2 writing course (Hamel, 2013b). The instrument included 20 items, with closed-ended questions (in English, with a five-point Likert scale) and semi-closed-ended and open-ended questions, divided into two parts: *My VSC experience in my L2 writing course and personal information* (demographic questions), and *My skills* (self-evaluation of language and technological skills).

The questionnaires were analyzed by Survey Monkey and, in part, using the quantitative analysis software SPSS.

Interviews

A semi-structured interview consisting of 10 questions was developed in order to ask the two instructors about their initial perspective, their reasons for using VSC, their VSC experience, and perceived issues and challenges, and to review their recommendations.

The post-intervention interviews were recorded, transcribed and analyzed using the Transana qualitative analysis tool (Woods & Dempster, 2011). A thematic analysis (Denzin & Lincoln, 2003; Silverman, 2006) identified the highlights of the experience and the value and relevance of the VSC tool.

Writing journal

The journals requested and completed in the FSL course were learning tools used to glean a more detailed analysis of the opinions of the students who took the course. Presented as evaluation tools, the learning journals were intended to help students monitor their own learning process while providing instructors with "valuable information on how students are processing the learning, kinds of problems and questions that some are reticent to raise in class" (Fenwick & Parsons, 2009, p. 51).

In the FSL course, the journals were mandatory and counted for a significant portion of the final grade (25%). This high percentage reflected the fact that journal-keeping (twice a week for 13 weeks) was a labour-intensive exercise, a sort of commitment to the task at hand and, consequently, a significant opportunity for the student to become an autonomous, "competent" writer in French.

Findings

Description of the data collected

Despite the small student sample, a large amount of empirical data was collected during the project, especially with respect to student-computer interaction. Participants produced over 200 VSCs, totalling more than 37 hours each, with an average length of 10 minutes. Also, there were over 500 entries in the FSL class's journals (an average of 30 per student). The following table shows the data collected during the *Writers in Action* research project.

Table 2: Data Gathered during the *Writers in Action* Project

Data	ESL writing course	FSL writing course
Participants recruited	18 students	18 students
Questionnaires completed	18 students	18 students
Number of writing assignments involving VSC	5 assignments	5 assignments
Participants who submitted recordings	17 students	15 students
Number of VSCs collected	116 videos	88 videos
Total duration of VSCs collected	20.41 hours	16.46 hours
Number of VSCs per participant (average)	6.4 videos (min: 4 videos; max: 10 videos)	5.86 videos (min: 2 videos; max: 18 videos)
Duration of VSCs per participant (average)	9.11 minutes (min: 4 minutes; max: 15 minutes)	11.46 minutes (min: 7.56 minutes; max: 15 minutes)
Total duration of VSCs per participant	1.07 hours (min: 27.15 minutes; max: 1.43 hours)	1.12 hours (min: 15 minutes; max: 3.25 hours)
Total number of journals (average per participant)		510 (30)
Semi-structured interviews (12 questions, duration: 1.5 hours)	ESL instructor	FSL instructor

Overview of the assignments designed by the two instructors

At the start of the activity, the co-researchers developed VSC writing assignment models for the two instructors. However, after the instructors received VSC training and had a few consultation sessions to discuss their syllabus, course objectives and planned key activities, they decided to redesign the writing assignments to better reflect their style of teaching and the course expectations. Following this redesign, we asked them to describe the VSC writing assignments they had developed using a checklist that included their objective, their nature, and the anticipated roles of the instructors and students. The following table provides an overview of the assignment described by the FSL instructor.

Table 3: Overview of VSC Writing Assignments Designed by the FSL Instructor

Assignments designed by FSL instructor				
Assignment	**Objective**	**Type**	**Student's role**	**Instructor's role**
Become acquainted with VSC and comment on it in the journal	Become acquainted with the tool and comment on it	Individual work at home	Learn to use the VSC tool	Monitor and verify the ability to use the tool
Revise a cover letter	Revise a written draft, identify a key aspect requiring revision related to the type of text	Individual work at home	Revise and evaluate the revision work in relation to the targeted point of grammar	Evaluator – written comments focusing on the revision process with VSC
Revise a narrative text	Revise the work using VSC, focusing on the type of writing. Indicate traces of appropriation	Individual work at home	Revise and apply specific instructions. Demonstrate the decision-making process used	Evaluator – using VSC to comment on choices made and the revision process
Revise an argumentative text	Use VSC to revise and modify a text, focusing on markers associated with the type of writing	Individual work at home	Think about the revision process and the use of VSC in the process. Be aware of writing-related choices	Evaluator – use text revision and evaluation tools and VSC to revise and clarify evaluations and to comment on the actions performed
Write, modify and revise – weekly journal entries	Optionally, use VSC individually to make entries in the writing journal and evaluate them continuously and critically	Individual work at home	Make more extensive personal use of VSC to illustrate personal writing processes and decision-making	Evaluator – overall observation and evaluation of progress in the writing, production and metacognition process

The writing assignments designed by the FSL instructor using VSC mainly involved revising a text. These assignments centred on aspects of the type of writing and were intended to foster appropriation of this type of writing. The students were expected to complete their assignments individually outside class. In their

writing assignments, the students had to revise, evaluate their revision, reflect on the revision and develop self-awareness as writers. As an observer of the writing process, the FSL instructor considered that her main role in the writing assignments was as an evaluator, providing feedback (evaluation, comments and suggestions) on both the writing process and its outcome. She also saw herself as a guide, encouraging students to think about appropriating the writing process and developing metacognition as writers.

The table below provides an overview of the writing assignments designed by the ESL instructor.

Table 4: Overview of VSC Writing Assignments Designed by the ESL Instructor

Assignments designed by ESL instructor				
Assignment	**Objective**	**Type**	**Student's role**	**Instructor's role**
Write an introduction to a five-paragraph essay	Practise university-level writing	Individual work in the lab	Writer, VSC user, thinker	Supporter and scaffolder of the process
Write a development paragraph	Develop and support ideas in writing	Individual work in the lab	Writer, VSC user, thinker	Supporter and scaffolder of the process
Prepare an essay outline	Brainstorm and prepare the essay outline as a team	Team work in the lab	Team member, VSC user, thinker	Supporter and scaffolder of the process
Revise	Correct grammatical errors and replace improper vocabulary	Individual work in the lab	Reader, reviser	Supporter and scaffolder of the process and the written product
Discuss an expert model	Demonstrate the writing process (using VSC)	Work in the lab	Thinker, note-taker	Presenter of an expert model to students

The writing assignments designed by the ESL instructor targeted specific elements of the writing process. They were "granular" and included specific objectives, like brainstorming at the text planning stage, error correction at the revision stage, etc. The students were expected to perform the assignments in the language laboratory, either individually or in teams. The roles that students were expected to fill were that of "thinker," facilitated by the use of VSC and, depending on the nature of the assignment, writer, reader, team member, reviser and note-taker. The ESL instructor perceived his primary role as that of "supporter and scaffolder" of the text production process, and at the same time, "supporter and scaffolder" of the product of this process, and presenter of an expert model.

It is interesting to note the creativity displayed by the instructors in the way they redesigned the writing assignments to incorporate VSC. We provided them with a checklist, with the specific intention of having them reconsider their situation and the situation of the students in these assignments, while incorporating the new technological tool in order to facilitate mediating and reflecting on the text production process.

Analysis of the VSCs produced by the students

Taxonomy of "observable" parameters

As mentioned in the methodology section, we defined the VSC analysis parameters based on the concept of on-screen "observables." These parameters related to a set of behaviours observed in the students performing the writing assignments. The behaviours in question consisted of interactions (visible actions) and verbalizations (audible actions). For analysis purposes, using our theoretical framework, we coded and classified them as functional and metacognitive strategies. We opted for a data-based classification approach. We therefore identified categories within the corpus of data by viewing the tasks observed in each VSC and describing them narratively and as objectively as possible, without any interpretation or judgement. In this way, we were able to inventory a variety of actions that appeared recurrently in the writing process. For example, we observed students in the process of writing, highlighting segments of their texts, revising their work, consulting language resources (dictionaries and checkers), describing or commenting on their actions out loud, displaying emotion, etc. All of these actions were compiled and formulated in terms of observable parameters, which were categorized by mode (visible or audible). The following table shows the taxonomy of observable parameters associated with the writing process.

Table 5: Taxonomy of Observable Parameters Associated with the Writing Process

Interaction *Functional strategies*	**Verbalization** *(Meta)cognitive strategies*
Prepare the environment Select a text segment Identify a problem (highlight or underline) Use a resource Insert a key word Search for information Return to the document Work on the text	Suggest a possibility Express internal knowledge Read the text Interpret information Provide a rationale Describe the action performed Evaluate Express a state Express a lack of knowledge Translate a text segment

Clearly, the behaviours associated with the writing process are rich and varied. We counted 18 behaviours in two main categories: online interactions (visible actions) and verbalizations (audible actions). These behaviours put functional and (meta)cognitive strategies into practice. While they come as no surprise, they confirm inferences made about the writing process, i.e., that students actually work on their writing by identifying and reworking passages that they consider awkward or wrong. As the analysis of the FSL VSCs shows, the students' behaviours as writers are not only varied but also numerous. The work of writing in a computer environment seems to promote and facilitate such behaviours. We see students making use of the affordances of the text editor and language resources external to the environment. The audio and, in some cases, the web camera enhance the documentation of the writing process. We also observe critical students thinking about their actions and decisions, asking themselves questions, formulating hypotheses and reacting emotionally to the writing process.

Analysis of the observable parameters in the FSL corpus

In our case study, we analyzed the observables in the FSL data, in which the VSCs reflect the writing process conditions that we considered more "organic" because they were produced at home on the students' own computers, at their own pace, etc. The VSCs of four of the five assignments were annotated (i.e., a total of 88 VSCs), the fifth being an assignment involving reflection on the act of writing rather than writing per se. The VSCs were categorized according to the chronological order of the assignments (T1 to T4), the type of text (hortatory, descriptive, narrative or argumentative), the title of the assignment (*letter of application, Carleton University campus, history of Carleton University, food services*) and writing journals (J1 to J9). For each assignment, we determined the number of VSCs and the number of students who produced them. For each VSC, we determined the number and the writing process observed (RD: writing; RV: revision; RT: feedback) and the type of verbalization, as applicable (PVR: verbalization-while-writing protocol; PVP: a posteriori verbalization protocol; and W: web camera activation). The following table presents details about the FSL VSC data.

Table 6: Details about the FSL VSC Data

VSC writing assignment	**VSCs produced by the FSL students**
T1: Hortatory (letter of application)	n = 18 VSCs/14 students: 15 RV; 2 RT; 1 RD;13 PVR; 1 PVP; 1 W
T2: Descriptive (Carleton University campus)	n = 15 VSCs/14 students: 13 RV; 2 RT; 1 RD;12 PVR; 2 PVP; 1 W
T3: Narrative (history of Carleton University)	n = 13 VSCs/12 students: 13 RV; 1 RT; 5 PVR; 1 PVP
T4: Argumentative (food services)	n = 8 VSCs/7 students: 8 RV; 5 PVR
J1-9: Introspective (writing journal)	n = 31 VSCs

We collected VSCs from 15 of the 18 participants in the study. A total of 54 VSCs were collected for T1 to T4. A total of 31 writing journals (J1 to J9) were also produced using VSC. The number of VSCs decreased as the students advanced from T1 (n = 19) to T4 (n = 8) during the term. VSC use during the course was voluntary, as was activation of the audio recording and web camera. The questionnaire analysis revealed the students' opinions of this new technology as evidence of and support for the writing process.

Most of the VSCs show students in the process of revising a text (RV). When students verbalize, they do so during the writing task (PVR), while only a minority do so a posteriori, during the viewing that follows the task (PVP). Only one student used the web camera twice (W), during T1 and T2, to document the writing process.

Compilation of observable parameters for T1 to T4

We annotated the VSCs for T1 to T4, so for 54 VSCs out of a total 85. The annotations entered in each of the 54 VSCs were compiled statistically: by VSC, category and type of observation, assignment and total number. The following table provides a detailed statistical compilation of the observables.

Table 7: Statistical Compilation of the Observables for T1 to T4 of the FSL Data

Observation	**Total number of visible actions**	**%**	**Observation**	**Total number of audible actions**	**%**
Works on the text	954	21.34	Reads the text	451	10.09
Selects a text segment	697	15.59	Describes the action performed	309	6.91
Uses a resource	592	13.24	Evaluates	207	4.63
Returns to the document	278	6.23	Provides the rationale	143	3.20
Inserts a key word	209	4.68	Suggests a possibility	115	2.57
Identifies a problem	105	2.35	Reads or interprets information	101	2.26
Searches for information	51	1.14	Expresses a state	74	1.66
Prepares the work environment	13	0.29	Expresses a lack of knowledge	73	1.63
			Expresses internal knowledge	72	1.61
			Translates a text segment	26	0.58
Total number of visible actions	**2,899**	**64.85**	**Total number of audible actions**	**1,571**	**3,515**

A total of 4,470 observables (2,899 visible actions and 1,571 audible actions) were identified in the 54 VSCs for T1 to T4. On average, 83 actions were observed per VSC (average length: 11.46 minutes). During the four assignments, the three visible actions (interaction or mediation with the text) most often noted were *works on a text; selects a text segment;* and *uses a resource*. The three most frequent audible actions were *reads text; describes the action performed;* and *evaluates*.

In general, the functional strategies observed consist of text correction strategies that can be interpreted as a direct result of the instruction in the writing course (assignment instructions and objectives). When working on their texts, students corrected spelling and grammar mistakes and tried to optimize their lexical choices. They focused on vocabulary, especially complex lexical expressions (collocations, preposition choices), and verb tenses. Traces of online mediation using internal and external language resources in the work environment, such as word processing, are clearly evident in the data. The inventory of resources consulted indicates a preference for the spell checker, bilingual dictionaries and thesauruses.

With regard to actions associated with metacognition, students reading their texts looked for errors or tried to correlate form and meaning. When they described their actions, they often did so for the instructor's benefit, to clarify and explain their actions. They evaluated when they were unsure of a word, wondering whether "you can say that" or not, or expressing satisfaction or dissatisfaction with a solution.

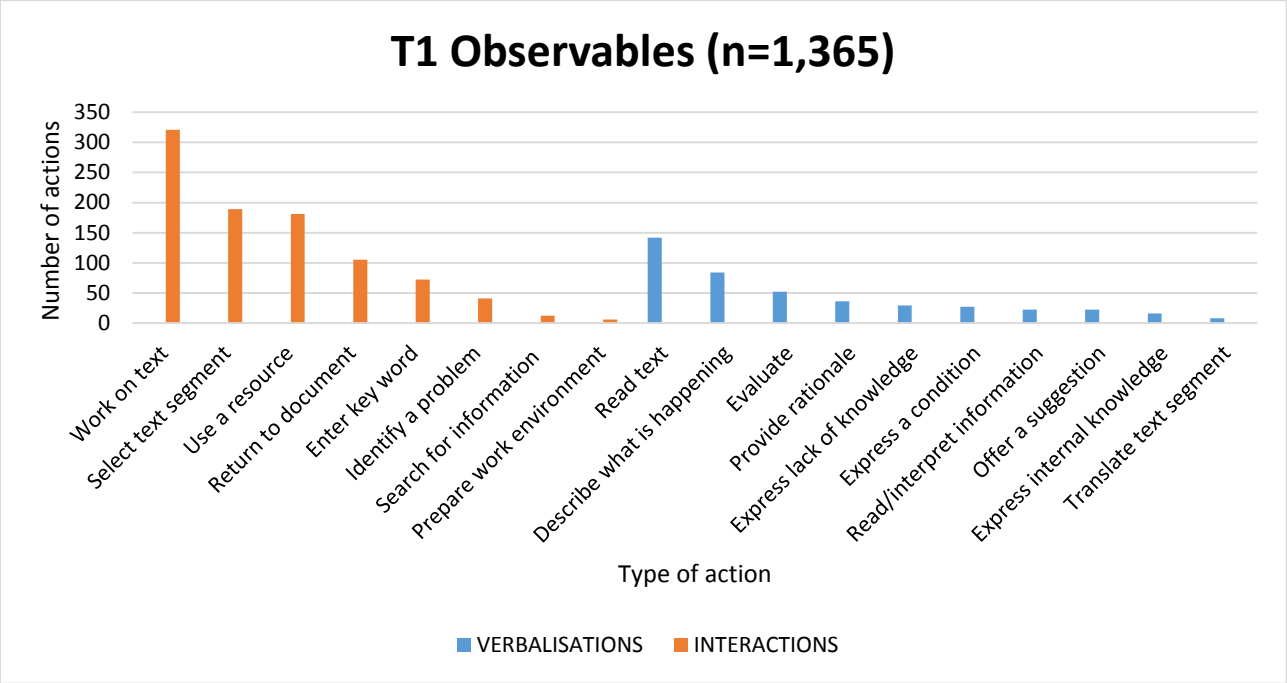
With an average of eight actions per minute, it is safe to say that the students were active. They were engaged in the assignment, making several attempts to correct and rework their writing, and they concentrated on form and meaning. This is evident in the questions spoken aloud, when students often turned to language resources to improve their texts.

Most students chose to verbalize their writing process as they saw fit, at least for T1 and T2. Their verbalizations shed light on their thinking and introspection. It is especially interesting and reassuring from an educational point of view to see students evaluating their performance and decisions.

Analysis of an assignment

In the detailed analysis of T1, 1,365 observable parameters were identified in 18 VSCs produced by 14 students. This is an average of 76 actions per VSC and 98 actions per student. The students produced these "efforts" when capturing a segment (13 minutes on average for T1) of their writing process, which may have taken longer than the process that was filmed. In fact, as noted in the section on questionnaire analysis, some students felt pressured by the 15-minute VSC time limit. A minority of students felt a need to create more than one VSC for the same assignment. The following figure shows the distribution of observable parameters by type of action for T1.

Figure 1: Distribution of Observable Parameters for Assignment 1



The visible and audible actions observed during the filmed process for the first writing assignment demonstrate the same distribution observed for all the assignments. We see that the students were mostly working on their texts (writing or revising). They consulted internal language resources (integrated into their text editor, for example, right-clicking to get a synonym) and external language resources (on the Internet) in the digital writing environment (MS Word in all cases). This process began with the attention focused on form, i.e., linguistic units, specific text segments that the students highlighted, bolded or underlined. Most cases involved a word or expression (lexical). With regard to prominent verbalization strategies, we note that the students most often read their texts aloud, described their actions and evaluated their decisions and performance.

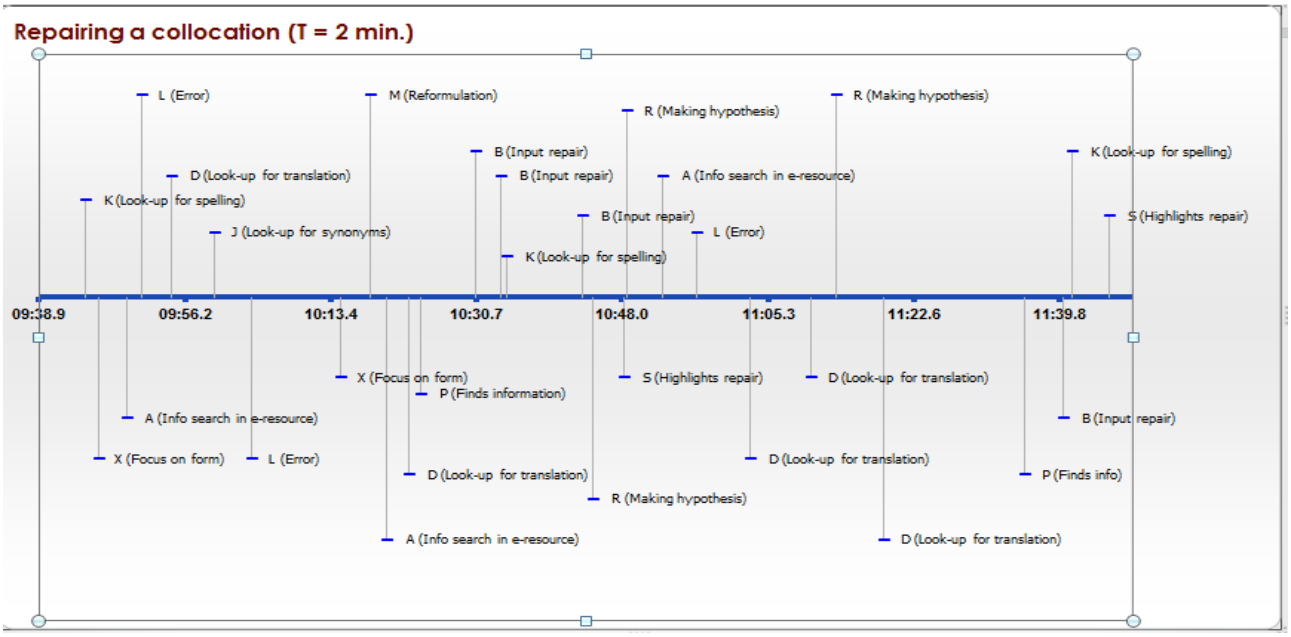
A careful examination of the distribution of observable parameters for each student revealed idiosyncrasies in his or her particular writing process. For T1, for example, the total number of observed actions varies between a maximum of 174 and a minimum of 19. Student E8, who produced the largest number of actions during the VSC in RV-PVR mode, used a range of strategies, the most frequent being *selects a text segment* (n = 28); *reads the text out loud* (n = 24); *works on the text* (n = 19); *evaluates* (n = 16); *suggests a possibility* (n = 15) and *describes the action performed* (n = 15). In contrast, student E3, who produced the fewest actions during the 14.36-minute VSC in RV-PVR mode, primarily used the following strategies: *works on the text* (n = 6) and *reads the text* (n = 6). Student E12, who produced an average number of actions (n = 80) in a 15-minute VSC in RV-PVR mode, used the three following strategies: *works on the text* (n = 34); *uses a resource* (n = 12); *reads the text out loud* (n = 11).

Profile of a writer in action

Our aim in this section is to build a profile of a *writer in action* to provide a concrete picture of the actions that characterize the writing process and to see what they reveal.

Student E7 is a diligent student who produced one VSC for each of the four assignments in the FSL course. He used VSC to document his text revision (RV) process and spoke out loud during the process (PVR). His VSCs contain many visible and audible actions, revealing a range of functional and metacognitive strategies used during the revision process. A detailed analysis of his T1 shows 116 visible and audible actions produced during the 15-minute VSC. In the filmed process, we see E7 explaining the writing assignment, preparing his work environment, producing a statement of appropriation of his text – *"I really want to work on my action words"* – which reflects his aim of focusing on complex lexical forms (collocations). He made use of authentic, professional language resources. These were print resources (he could be heard turning pages) and online resources; language resources such as *Bon Patron* (a grammar checker for FSL students) and *Linguee* (a concordance); and the *Dictionnaire de cooccurrences* by J. Beauchesne (hard copy). He clearly knew how to take advantage of the affordances of these resources, finding his information and reformulating his text accordingly. By using annotations (in English only) entered in real time in the VSCs, we were able to reconstruct a sequence of actions corresponding to student E7's attempt to repair a collocation.

Figure 2: Reconstruction of a Sequence of Actions to Repair a Collocation



This sequence takes about two minutes. It starts with the student focusing on linguistic form (*je possède des connaissances *ample en Microsoft Office*) and then consulting a resource (dictionary). Next there is a search for information (in a concordance), followed by an error (no relevant information is found). A reformulation is attempted (*d'amples connaissances avec*), and then the search for information continues (a

translation). The information found leads to the repair of a part of the segment (*j'ai développé des compétences*); spelling is checked; the segment is repaired again (*j'ai acquis des compétences)*. A hypothesis is made but then discarded (*j'ai *accru*). Finally, the repaired segment is highlighted (*j'ai acquis des compétences avec…*).

Hence we see that lexical reformulation is a complex process. The student focuses first on the adjective, seeking unsuccessfully to replace it, and then substitutes one preposition for another (*en –> avec*). He then replaces the noun in this collocation with a synonym (*connaissances –> compétences*). Finally, he decides to replace the generic verb with a more specific synonym (*développer –> acquérir*). The modelling of this text repair segment is useful from an educational standpoint because it reveals every step in the process and shows the important role played by knowledge of lexical relationships, especially synonymy, in the ability to reformulate (Hamel & Milicevic, 2007). Such modelling makes it possible to adopt a documented, considered approach to the revision process; this approach includes wanting to improve the text, focusing on language form, and consulting language resources to make sensible choices (using synonymy and lexical substitution), which lead to reformulation. VSC enables such modelling, a methodical practice that helps identify expert models and novice models, both of which are useful in thinking about the writing process. The expert model contains good strategies, while the novice model has strategies that require optimizing (Hamel, 2013a).

Views of the two instructors

Analysis of the interviews

The following section contains a detailed description of the main themes arising from an analysis of the interviews with the two instructors. The interviews were highly informative and provided a better understanding of the instructors' motives and views concerning VSC. Despite differences in teaching style and level of familiarity with technology, both instructors confirmed the value of VSC in their writing courses and their interest in future applications of the tool for language teaching in general.

Both instructors believe that VSC is a natural complement to their instructional objectives and approach; it enables students and language instructors to observe and review specific moments in the interaction between students and their texts (with or without oral or written comments). This broad perspective provided by VSC is a major asset that "adds to the instructors' toolbox." For students, VSC helps trigger thinking and awareness. For instructors, it offers new ways of encouraging students to think, scaffolding the writing process and interacting with students in their personal efforts to improve their writing skills.

A valuable tool for reflection

With regard to critical thinking, the FSL instructor noted at the start of the interview what VSC had contributed to her course in combination with the students' writing journals. By explicitly showing (and hearing in some cases) students working on the computer or explaining their process, VSC makes it possible to *"get inside their heads"* and better comprehend how they understand and interact with their texts. It thus becomes possible to more clearly perceive the students' strengths and weaknesses, the resources they use, the skills they have acquired and the extent to which they have mastered them.

Similarly, the two instructors suggested that encouraging students to think about the VSCs of their writing process helped "*open their eyes"* and put them in touch with their "*own reality as writers."* The instructors explained that VSC enables students to learn to think and work in practical ways, not only on their final texts, but also on their processes. They stated that VSC aligns very effectively with a metacognition-based approach. They further noted that students can learn a great deal about themselves when they are encouraged to see themselves as writers and asked questions such as the following: *Where do you pause? What vocabulary items cause you problems? How much time did you spend on this part of your text?*

One major advantage, according to the ESL instructor, is that these questions help the students better understand the relationship between the results they achieve as writers (determined by the comments and grade they receive on the final evaluation of a text) and the specific actions and decisions that essentially account for these results. With VSC, students have access to additional information to better observe and consequently modify their writing practices.

A tool that enhances instruction

Similarly, both instructors noted that with VSC, they can use the information in the videos to modify their teaching. The instructor is better equipped to plan a lesson thanks to the more detailed and more comprehensive picture of what each student is doing and his/her identity as a writer (for example, what type of writer is he/she? *An unfocused surfer. A flexible, effective student. A slow, ineffective writer.*). Instructors can also better evaluate and guide students when they interact with them in person, as the ESL instructor did in recommending specific actions based on the student's VSC observables and good or bad habits.

VSC can also give students a tangible picture of the processes they need to learn. The ESL instructor emphasized this affordance of the tool, explaining how he used VSC to provide his students with a video featuring a colleague in the process of writing a text and explaining his actions out loud. This VSC was shared with students and discussed in class, to their great enjoyment. VSC made it possible to present an expert model of the writing process.

VSC also provides a useful way to communicate with students. The FSL instructor, who used VSC to provide feedback on students' texts, underscored this potential use of the tool. With VSC, an instructor can spend "*a lot more time clarifying the nature of the problem"* and explaining matters directly to the students, since he/she is no longer limited to writing. This form of multimodal feedback was greatly appreciated by the students because "*they can see me"* and "*they really liked hearing me and following me. They really enjoyed that presence."*

A tool that fosters self-reliance

According to the FSL instructor, the tool fosters the student's language autonomy. She commented that VSC "*provides grist for the mill of self-reliance"* because the students are encouraged to understand themselves what they are doing when they write. They leave class knowing that they can write and then review their performance slowly, with the benefit of hindsight, and correct actions that, over time, can become automatic and therefore much more difficult to change. At the same time, for the ESL instructor, the goal is

to help students independently answer the question, "*How did I arrive at a specific result?*" Students who can answer this question are better equipped to improve on their own because they rely less on the instructor to judge the quality of their texts and the processes they followed in writing them.

According to the instructors, a student who learns to use VSC can see better and therefore better understand the value of taking their time, for example, and approach writing as a skill that requires long-term development. The student is also more likely to become aware of the specific linguistic elements (points of grammar, a lexical deficiency) that require work.

Limitations and recommendations

Despite their positive reaction to incorporating VSC into their writing courses, the instructors mentioned some limitations to bear in mind when it comes to recommending the tool to colleagues. They emphasized the importance of considering the logistical factors involved in using VSC. Any instructor or program coordinator interested in incorporating this technology must plan far in advance how the tool will be used and the resources required to achieve the specified objectives.

According to both instructors, training and careful planning are vital. The use of VSC in class cannot be improvised. Instructors must know ahead of time what they have to do (because there are so many possibilities), and ideally they should have instructions (e.g., checklists with precise objectives to accomplish in a written rather than oral VSC assignment). Ideally, model VSC assignments should also be available to help students and instructors understand what must be done and the potential benefits. Logistically, arrangements must be made for a place to use the tool (will the students create their VSCs at home, in the lab, or both?). The two instructors acknowledged that it was better to use VSC in a lab whenever possible. Lab use makes it easier to introduce students to the tool and to directly incorporate VSC into classroom activities. Both instructors stressed that all instructors must be properly trained (they recommended the type of training mentioned in this research). In a training course, the tool can be explained in detail, questions can be answered patiently and, most importantly, a rationale can be provided for students who may initially fail to see the value of recording themselves when they produce or revise a text.

The two instructors strongly emphasized the benefits of exercises in which students record their thoughts and ideas out loud so that they would have access to their *thoughts* and *processes*. Both instructors believed that this type of exercise (a new type of activity for most students) must include clear explanations specifying the importance of developing and thinking aloud about a choice or decision during the recording session.

> *Even one student who was initially reluctant to use the tool liked it. Believe it or not, she was one of the biggest fans of Screencast-O-Matic. She came to talk to me at the end of the term and said, "You know, at the start of the term, I wondered why I had to share the privacy of my writing process with you. But toward the end, I realized that I had improved a lot [...] I see that I'm writing better now [...] I'm writing more confidently [...] I can't say that it's all because of Screencast-O-Matic, but the tool helped me a lot."*

Finally, both instructors advised extending the 15-minute recording limit.[2] This would ensure that students would not have to work "under pressure" in a recording session that could be cut off, a concern that students mentioned to the instructors.

Continue innovating with VSC

Subject to these general recommendations, the two instructors recommend VSC and suggest that the action research should continue in order to help explore its potential in language courses. Here is what they had to say:

> *"It really is worthwhile, it contributes something [...] It's sure to bring up interesting discoveries for instructors and students. The tool lets you 'see into the student's process' and gain a 'priceless' perspective that can 'completely change how a student approaches writing,'"* said the FSL instructor.

> *"Essentially, in some cases, Screencast-O-Matic lends itself perfectly to the type of exercises I give the students [...] It's very well designed [...] I think it will be used more often [...] It's probably up to us to promote it, inform our colleagues and tell them about its advantages [...] I think I will definitely use this tool in my course,"* commented the ESL instructor.

This positive assessment of the tool was evident when we asked the instructors if they intended to keep using it. Both answered in the affirmative, saying they would even consider using it in courses focusing on skills other than writing. The ESL instructor would like to use it to improve reading and comprehension skills, for example, while the FSL instructor plans to use it to teach and improve oral proficiency.

Views of the students

Analysis of the questionnaires

As mentioned in the methodology section, the questionnaire was handed out to the students (n = 36) to gather information about their satisfaction with VSC technology, especially their perception of its utility in the L2 writing course. Below is a list of the key points covered in the questionnaire, including (1) VSC preparation and use, (2) the tool's components, (3) its usefulness, and (4) the impact of the VSC experience. The results were evaluated on a three-point scale and, as appropriate, we distinguished between the FSL and ESL classes. The results are shown in the tables as percentages.

VSC preparation and use

As Table 8 shows, most students said that it was easy for them to learn how to use the VSC tool; their skill in using it improved with practice; they did not encounter serious problems with the tool; and they were able to resolve the problems they did encounter. The students said they enjoyed or somewhat enjoyed using the tool. Some said that they did not initially understand how the tool would be of use to them in the L2 writing

[2] This limit can be extended if the instructor subscribes to the professional version of Screencast-O-Matic.

course. However, most realized its usefulness as the course progressed. While almost half stated that they would use VSC again in another course, one-third said that they would not. The following table shows the questions and the relevant percentages.

Table 8: VSC Preparation and Use

	Disagree	Somewhat Agree	Agree
It was difficult to learn how to use VSC	77.8 %	19.4 %	2.8 %
Over time I improved by using VSC	8.3 %	33.3 %	58.3 %
I encountered several problems using VSC	72.2 %	19.4 %	8.3 %
I was able to resolve the problems I encountered in using VSC	11.4 %	28.6 %	60.0 %
I don't like using VSC	40.6 %	33.3 %	11.1 %
In the beginning I didn't understand the purpose of using VSC in my L2 writing course	27.8 %	41.7 %	30.5 %
I better understood the purpose of using VSC in my L2 writing course as time went on	11.1 %	36.1 %	52.8 %
I would be willing to use VSC again in other courses	33.3 %	22.2 %	44.4 %

Components of the VSC tool

According to the students, the most useful components of VSC are the audio commentary and the personal VSC library. However, they did not consider the web camera useful and, as the data show, very few of them used it. However, the instructors and the researchers found the opposite to be true. In their opinion, the web camera is useful because it shows the learner in action, along with facial expressions and gestures that often corroborate what he/she says. An analysis of the questionnaires completed by web camera users revealed that they found it useful. Most students considered the possibility of monitoring what was happening on screen to be useful or very useful. The following table shows the findings.

Table 9: Components of the VSC Tool

	Not Useful	Useful	Very Useful	N/A
Video of actions on the computer screen (mouse movements, keyboarding, underlining)	5.6 %	44.4 %	50.0 %	
Audio commentary	11.1 %	22.2 %	66.7 %	
Web camera use	55.6 %	16.7 %	8.3 %	19.4 %
Ability to exchange videos using hyperlinks	11.1 %	38.9 %	44.4 %	5.6 %
Access to the online personal video library	11.1 %	25.0 %	63.9 %	

Usefulness of the VSC tool

For this section of the questionnaire, we distinguished between the results of the FSL and ESL classes, because of the different writing assignments used in the two courses. We compiled the majority results. We found that a very high percentage of students (higher in the ESL class) considered the VSC tool to be very useful for obtaining feedback from the instructor. In this regard, one student commented:

> *I liked getting personal comments back from the instructor. I was able to refer back to them whenever I wanted during the term.*

An almost equally high percentage of students (higher in the FSL class) considered VSC to be very useful for developing awareness of the writing process. The following are some comments from students that corroborate this observation:

> *VSC helped me realize that I can monitor my mental process, and when I look at my videos later, I can see what I was thinking at the time. I also realize that I have to improve my texts.*
>
> *Through VSC, I noticed that I had to improve my writing, which I managed to do by seeing what I was doing wrong.*
>
> *Screencast-O-Matic has more positives than negatives. I think this software is extremely useful. It gives you a chance to review your writing once it's finished. The application also includes a record function that I can use to record what I say while I'm writing.*

Also, a large majority of students enjoyed using VSC because the instructor could provide feedback to the entire class on the observed writing process.

Students in the ESL class found VSC especially helpful in planning and composing the rough draft of a text. Most students in the FSL class considered VSC very useful for text revision and editing. Here are their comments in this regard:

> *The SOM software gave me time to revise my L2 writing work. Before I used SOM, I tended to revise while I was writing, which stopped me from producing the high-quality writing I produce now. Now I really take the time to revise my work.*
>
> *The SOM tool is useful in every respect because it helps students learn and it helps instructors see the kinds of mistakes students make in the writing process.*

The table below shows students' production of VSCs for their own use and to allow the instructor to monitor their writing process.

Table 10: Usefulness of the VSC Tool

	FSL course	ESL course
LEARN ABOUT:		
Planning a text	50.0 %	55.6 %
Preparing a draft	38.9 %	55.6 %
Revision	64.7 %	50.0 %
Feedback from the instructor	77.8 %	88.9 %
Sharing the text with the instructor	44.4 %	55.6 %
Sharing the text with peers	55.6 %	50.0 %
THINK ABOUT:		
The steps involved in writing	55.6 %	50.0 %
Using the computer	38.9 %	77.8 %
Using language resources	50.0 %	44.4 %
GAIN AWARENESS OF:		
One's own writing strategies	50.0 %	50.0 %
The general process of writing	50.0 %	55.6 %
One's own writing process	72.2 %	61.1 %

LEGEND:
Not Useful
Useful
Very Useful

Usefulness of VSC assignments and activities

In the section of the questionnaire on perceptions of the usefulness of assignments and activities designed with VSC, 81% of the students reported that the VSC tool had helped them write better texts by encouraging them to think about their writing habits and the improvements observed. The following is a comment made in the open-ended portion of the question that corroborates this observation:

> *I think that all of the activities were very useful. Every time I used SOM, it became easier for me to see my mistakes when I read out loud.*

According to the students, the most useful activity (86%) was feedback and comments from the instructor using VSC, as shown by this comment entered in the open-ended portion of the question:

> *The audio corrections for my essay made it feel like the instructor was right beside me.*

However, students did not find the VSC collaborative assignment very useful, as the following comment shows:

> *As far as I'm concerned, the least useful SOM activity was the team (two-person) exercise. The reason is that the partner somehow took on the role of a checker.*

As mentioned above, some students found the time limit (15 minutes) imposed by the VSC tool stressful. The following comment supports this assertion:

> *I don't think it was very effective to correct spelling and grammar mistakes during the video capture. Considering the time limit, I was hurrying and so I missed a lot of mistakes. Overall, this process is less useful.*

One open-ended question concerned what students had realized by using VSC. Here are two of the answers given:

> *I should revise my texts in a more systematic, organized way.*

> *I have to improve what I write. I was able to do so when I saw what I had done wrong.*

We noticed that the multimodal, visual and dynamic aspects of VSC help students see their text and the work that remains to be done more clearly.

Impact of the experience with the VSC tool

In the ESL and FSL classes, we observed a fairly positive reaction from students to incorporating VSC into their L2 writing course. The VSC tool enabled them to focus more effectively on their writing, to improve as writers and to produce better texts. Their experience was generally positive. The students agreed that the VSC tool should be used in writing courses. They also saw its usefulness for other types of language courses.

Table 11: Impact of the Experience with the VSC Tool

	Disagree	Somewhat Agree	Agree
In general, VSC helped me concentrate better on my text	8.3 %	47.2 %	44.4 %
VSC helped me improve as a writer	14.3 %	40.0 %	45.7 %
I think VSC helped me write better texts	16.7 %	38.9 %	44.4 %
My general experience in using VSC was positive	2.8 %	50.0 %	47.2 %
I think that VSC should be used for writing	8.8 %	38.2 %	53.0 %
I think that VSC would be useful in other language courses (such as oral communication)	11.1 %	30.6 %	58.3 %

In light of these results, we recommend that the tool's uses and applications be explored further and that its affordances be applied to other language learning situations and other academic subjects. The following are a few suggestions made by students in the questionnaires:

- *It's useful for brainstorming.*
- *Provide opportunities to discuss our work with classmates.*
- *Peer evaluation (mutual revision in teams of two).*
- *Recording team discussions for group writing exercises.*
- *Preparing examples and showing them in class.*

To conclude this section, we should mention that the questionnaires showed how easy it was to use VSC and how it

- supported and documented the writing process;
- provided feedback to students on their text and their writing process;
- gave students an opportunity to review their work and learn how they write (i.e., their specific practices, how successful they are compared with less successful practices, their weaknesses, their strengths and their mistakes).

These results, combined with the results of our analysis of the VSCs, reveal the learners' self-efficacy and self-regulation capacities (Zimmerman & Schunk, 2001) and their achievements as they become active observers and commentators on literacy practices that promote autonomy (Benson, 2001).

Analysis of the journals

An analysis of the 11 journals on VSC use in the FSL course leads to some general thoughts about users. This comes as no surprise in view of the essentially unrestricted nature of the work involved in writing a journal. The journals contain comments about the relative ease of working with VSC, and along the way provide a few anecdotes about the initial sessions, whose results were less compelling. With some degree of candour, the students explain their approach and impressions, sometimes making direct connections between VSC and what they see as its impact. An analysis of the journals directly or indirectly produced data associated with the deployment of the VSC tool, but also a few impressions and clarifications about the tool's role, its value and even its impact in the comments entered in a journal. The comments consist of brief texts, between 200 and 300 words in length, preceded by a statement of linguistic focus (for example, *I am watching my adjectives; I am working on punctuation,* etc.). This statement is followed, in each journal in the case of the FSL course, by a critical comment about the application and the work required to complete the focusing task initially described. Based on the perceptions and interpretations noted in the journals about VSC, our attention was drawn to three frequently and specifically mentioned aspects: (1) individual characteristics and attitudes based on or owing to the use of VSC in the work; (2) the identification of values or benefits related to the VSC tool specifically in the FSL course for developing the writing process; and (3) comments or judgements on the value of using VSC and its impact on the student's writing process.

Technology users

The comments shed light on characteristics of the users who, while not experts, were seldom technological neophytes. These comments by the technologically adept probably explain their indifference at the introduction of "another" technology into one of their courses, and their relative comfort with VSC or how they interpret it. However, this indifference did not mean that they were familiar with VSC. Before the activity, only one student had ever specifically heard of "this" VSC, although some knew about this type of technology. Almost everyone was therefore a first-time user. As with any other attempt to introduce something new, some people were more comfortable than others. Some said that they were curious about the new instrument, while others were not, with a middle-of-the-road group of users generally familiar with technology who said with little hesitation that the VSC website "*is not complicated, even for people who are not good with technology*." For the few who were less technologically adept, for those who did not consider themselves "*technology experts"* and certainly not "*up on VSC,"* for those who found VSC "*outrageous"* particularly because it did not "*provide comments*," for those who were afraid of the microphone "*because they did not want to mutter too much during the session,"* for all those people, it took them a while to learn how to use VSC properly.

The students also appreciated the technical support provided either directly by the research team or through support documents provided at the outset. Everyone who used these supports noted the importance "*of having the presentation at the same time as their first session with the program," "to make sure it works smoothly."* The value and effective simplicity of the information presented in the VSC user sheet in clearly explained steps were perceived as "*a kind of beginner's guide."* Some students simply plunged headlong into the new instrument without considering anything but its mandatory use in the FSL course. The comments recorded after these "plunges" often reflected, directly and based on experience, regret at not having approached it "*properly"* and a few "consequences" or "after-effects":

> *I didn't talk the first time, so [...] I only heard the sound of my fingers typing, which isn't much help in learning a language.*

The characteristics of users in the FSL course, depending on their familiarity with technology, were like those of any first-time user. They were either confident and effective or not; they were not "afraid" of the technology, were interested and wanted more, or were afraid (of the microphone, for example); or they did not know what to do with certain functions, like image. Of course, most fell between these two extremes, i.e., people who saw the benefits, pointed out a few disadvantages or saw some utility in the VSC tool and a role for it, noting that it was due to the fact that they were able to observe their own writing process.

Mindful writers

While most students generally proceeded more or less systematically by trial and error and one small step at a time, everyone managed to make relatively problem-free use of VSC. As they produced more VSCs, the writers formed habits both in recording and in the critical, informed approach attributable to VSC, and they commented that the work method had generated relatively useful spinoffs for them. In this regard, we noted comments on benefits such as the value of observing writing methods; the observation that in future, they would have to be more mindful of the advantage of making comments out loud; and finding something interesting and specific in one's observables. One student remarked that she could *"see"* herself for the first time working on a text and "*that she often erases words and sentences as she tries to find the right way to express what she wants to say*." Lastly, another participant acknowledged that when she *"captured"* herself using VSC, she noticed *"her little habits"* and admitted that she is now *"curious to discover what she might learn by watching her VSC*."

The "usefulness" of VSC to students depended on their approach to it. Depending on whether the student was more or less "mildly" engaged or curious and willing, whether he/she manifested and identified connections between the tool and its effect on his/her behaviour, whether actions or decisions were taken following observations based on a VSC, students at the outset placed some value on the VSC instrument. Several reported a change in behaviour or a new approach after using VSC. These decisions show the moment when students take greater responsibility for their learning process and find methods that lead to a generally constructive learning phase. Although these "moments" are not always and exclusively a guarantee of success (mistakes remain), they are turning points in performance, a step forward in personal assurance of a better product, which is generally the case, but also and most importantly, renewed confidence, a manifestation of expertise, a willingness to persevere in all sorts of ways in writing, in this course and others, and in other work both academic and professional.

Several added benefits

Whether these VSC-related *"moments of assurance or progress"* are associated with an initial error, such as failing to speak out loud and noticing it, whether they are the result of a gradual discovery of the *"benefits associated with this type of revision"* for others, or whether there is a genuine observation that VSC facilitates error correction, these circumstances all lead to a recalibration of the effort, the approach and the time allocated to it. These moments appear and are perceived as opportunities for students to see themselves in action, which provides them with useful information about how they perform their

assignment. For some, on the other hand, VSC offers the possibility of showcasing themselves, which leaves students delighted to be able to "*show their tools [...] including websites and computer programs."* They are also grateful for the opportunity and the pleasure of talking about their work, "*of having the chance to hear their own voice and practise reasoning out loud."* VSC therefore offers a unique opportunity to observe significant information directly, even when such information is known to the student, and still more when it was not.

Finally, it is noteworthy that some students identified less conventional benefits of VSC, namely the development of oral skills. "*It's excellent software for people who want to learn to speak a second language."* Some pointed out that VSC is also an *"excellent software for corrections by the instructor […] a means of knowing exactly what they are thinking,"* a long-standing point of curiosity for some. In fact, student E7, described briefly above, saw what he calls *"the educational function of VSC"* as its *"only true value*," particularly for writers like him who were already well informed and actively engaged in writing prior to using VSC.

In conclusion, the journals confirm the findings based on the other data collected. They also attest more anecdotally and candidly to the impact of VSC technology on the writing process and its products. In addition, we observed self-reliance, the increased sense of self-efficacy and self-confidence, together with the impression of better learning opportunities, specific opportunities *"to think more effectively,"* although some candidly admitted they are *"not very good at the thinking process."*

Discussion

In this section, we discuss the findings while trying to answer our research questions.

Conditions conducive to integrating VSC in a second-language writing course (RQ1)

Selection of the VSC tool

The results of the questionnaires completed by the students and the interviews with the two instructors clearly indicate that VSC is an accessible, user-friendly tool. These results validate the choice of software for the study: Screencast-O-Matic. The fact that it is free (in its 15-minute version) and robust, and the possibility of saving VSCs in different formats make it highly convenient and worth recommending for anyone interested in VSC. The main advantage of software like Screencast-O-Matic is that it does not have to be installed on the computer.

Training and documentation

We also saw the impact that training has on ensuring that new technology is thoroughly understood and properly used. Training must be delivered in advance and should ideally include coaching (by a trained assistant or peer). Documentation is also vital. For the instructors, we described the affordances of VSC technology and created language assignment (writing) models incorporating VSC. For the students, we produced a PDF document in French and English entitled, "How to use Screencast-O-Matic (the VSC tool) in 12 easy steps." Training and documentation minimize the pitfalls. The instructors and students did not encounter long periods of downtime or moments of panic after they received training and user guides.

"Ergonomic" design of writing assignments incorporating VSC

Ergonomic design centres on user needs. Thinking in ergonomic terms means referring to concepts of "comfort" and "quality." In this regard, writing assignments that incorporate VSC must relate to and address actual needs perceived by language students and instructors alike. We clearly expressed these needs in our findings, namely, wanting and being able to document the writing process using VSC in order to better understand, see, evaluate and think about it. The goal is to improve the support provided to students in this process and the outcome. The assignments devised by the instructors were intended to meet the objectives of their respective courses by enhancing students' existing skill and know-how.

Possibilities available to instructors and students in terms of instructional assignments incorporating VSC (RQ2)

A technology with multiple affordances

A pedagogical trail of students' work

VSC makes it possible to capture the writing process and create a comprehensive pedagogical trail of the students' work in all of its vitality, which no other technology has as yet succeeded in accomplishing with as much objectivity. The trail that documents the writing process makes it visible. By making the process visible, it becomes accessible to students and instructors. Together, they have the opportunity to see something new. This collaborative vision encourages exploration of the material to be learned and taught.

Students' introspective approach

VSC offers various possibilities when it comes to writing assignments, including one vital to learning: facilitating students' efforts to reflect on their behaviours as writers. The use of VSC fosters what the FSL instructor sees as "mirror" pedagogy or "self-portrait" instruction, which is entirely consistent with the current use of technology. Seeing ourselves allows us to know who we are when we write. VSC offers students a means of working independently. Using it to document the writing process provides greater "awareness" of personal writing habits and their effectiveness or ineffectiveness, as the results of our analysis show.

Apart from an ongoing commitment, the VSC-assisted writing journal was used to create not only specific writing assignments but also ongoing contact with an autonomous learning space, a recurring site for reflection, a "mirror" that supported and observed the perception that, by force of circumstances, students eventually gained of their progress, as demonstrated by previous work (Dion, 2011).

A student-instructor dialogue fostering deep thinking

The use of VSC for instructional purposes reinforces the dialogue between language instructors and students. Because it initiates such a dialogue, an instructional activity becomes possible that focuses on the writing process and its outcome, and on the thoughts shared by the students on the subject. An analysis of the observable parameters in our FSL corpus corroborates this observation.

Being asynchronous, the dialogue mediated by VSC enables deep thinking, whose effectiveness is assured by the multimodal nature of VSC.

Personalized multimodal feedback

Multimodality is key to learning a language. It enables the acquisition of reading, writing, listening and speaking skills. In this regard, VSC is a powerful feedback tool. Students perceive the multimodal feedback from instructors using VSC as more personal, more "human." This capacity for personalized feedback is what students liked best. It enables instructors to focus their feedback on the strategies and behaviours observed in the student during the writing process, rather than concentrate exclusively on the final result (the text). This feedback work could be incorporated more specifically into the course evaluation methods and the metacognitive objectives (reflection) that the instructors are trying to achieve with the students. This was pointed out by the FSL instructor during her interview. VSC is no longer limited to what takes place in class or what can be deduced by analyzing the final product of an assignment. It is an inherently "liberating" technology in a language teaching and learning context.

Characteristics of an optimal writing task

When we analyzed the writing assignments designed by the instructors, we paid special attention to the characteristics of an optimal task, i.e., a task that encourages the transfer of key concepts involved in the *writing* process. These characteristics are as follows:

- A properly directed task that has been planned, scripted, modelled, supported and evaluated; a task that includes checklists or detailed instruction sheets to guide students in the process and provide direction on specific aspects of the process;
- A task that encourages and enables verbalization during the writing process, given that the multimodal trace is more detailed and conducive to metacognition;
- A task that encourages reflection and allows the students to review their process, their texts, and what they see and notice;
- A task that includes feedback mediated by VSC, that targets strategies, observed behaviours and the results of actions, and provides recommendations to improve the effectiveness of the writing process.

In short, VSC is a multi-purpose tool. As long as its use is defined and students receive guidance on its use, it can be used effectively.

Benefits of using VSC (RQ3)

The use of VSC in the two courses offered several benefits to the instructors and students in terms of developing the students' thinking skills, language proficiency and autonomy.

With VSC, the students and instructors gained access to a relatively simple, practical and economical technique for recording their computer screens, voices and images. VSC offered the possibility of looking at the act of writing from an unusual perspective and introspectively, by capturing and reflecting, in a tangible way, as if in a mirror, the processes and actions that are often invisible in a writing course. By capturing the

specific practices of individuals (both what was done, and perhaps said, and what was not), the students and instructors were able to share, analyze and explore every detail of the writing processes in a new way, without sacrificing their fluid, dynamic aspects.

The instructors were able to achieve their instructional objectives while providing innovative ways of encouraging the students to reflect on and understand the processes and knowledge associated with writing, and for themselves, innovative ways of observing and measuring their students' language skills. Through VSC, the students were able to better observe themselves and "study" (in class, but mostly outside class, independently) the relationship between the language skills being taught (for example, use of the subjunctive to express an opinion), the strategies and actions of a *writer in action* (for example, the time spent on planning and outlining before composing a text), and the quality of the final text (for example, a text considered well or poorly written based on specific criteria).

The instructors and students were also able to use the tool to better communicate with one another by visually and verbally supporting their comments on specific texts (during modelling and feedback exercises, for the instructors, and during explanations of what they had done, for the students). In addition to improving dialogue and the quality of learning, students' increased proficiency with VSC will allow them to continue creating and exchanging VSCs so that they can communicate more effectively and explain the reasons for and consequences of their actions. At the end of their course, all of the students realized the advantages of creating an archive of their practices that they could later revisit. They will be able to continue adding to this VSC archive, and even return to it to get a clearer picture of the state of their writing skills, or look back over the strategies or knowledge covered in the writing class.

Finally, over the long term, the quality of the trails produced by the integration of VSC offers benefits for instructors. They too can re-examine the VSC archives produced by their students to identify examples of specific moments and actions that illustrate important opportunities or obstacles for L2 students. The VSCs collected by the instructors form the basis for a collection of videos that they could use as models and sources of information about the types of questions that students ask themselves, the kind of difficulties they encounter and, most importantly, the way the explanations and knowledge conveyed in class are retained and assimilated into the students' writing processes. In the long term, we expect that the VSCs will constitute a major advantage for instructors interested in improving their writing courses and the way they design instructional assignments.

VSC's value added as an instructional approach for language instructors (RQ4)

Beyond the limitations of the classroom

VSC is a multimodal tool that has the potential to significantly enrich language learning. It enables instructors and students to accomplish something that would quite simply be impossible with traditional instructional tools. As we have said before, VSC is

- A new way of thinking (or encouraging thought);
- An asynchronous multimodal dialogue that allows for extensive reflection on a text, which fosters "deep thinking."

Introduction to producing multimodal digital documents and trails

In a modern world where the ability to work and collaborate using digital tools is increasingly important, this outcome is desirable and significant.

The four key applications of VSC

In our view, the following four potential applications are the most useful based on the results of our research. They include using VSC as a tool for:

(a) Reflection and introspection

To propose a "mirror" pedagogy, an introspective "self-portrait" pedagogy

As *writers in action,* learners using VSC adopt a certain way of thinking when they see themselves in action. They become introspective learners who

- are more and better engaged and with greater precision in the assignment and its completion;
- see the impact of their decisions and actions on the final product more clearly;
- see themselves and know who they are when they write and position themselves as *writers in action*

For awareness, metacognition, deep thinking

As mentioned, the data showed the tool's potential to encourage awareness among students and instructors, for VSC enables a metacognitive review of all decisions, resources, methods and strategies used in the writing process. The tool fosters engagement, reflection and critical thinking by the student and helps launch a discussion on the connections to be made among the various practices, information resources and strategies. Therefore, the tool fosters "deep thinking" – the ability to reach a new point of view by assimilating new perspectives and information.

(b) Tracing

Video screen capture makes it possible to remotely capture and analyze the decisions, resources, methods and strategies at work when a student writes

The ability to view the trails of many aspects of the writing activity enhances the understanding that instructors and students have of what is happening during their writing efforts. These trails assist in more effectively documenting and understanding the complex nature of the act of writing and, in particular, dispel the myth that exists in the minds of many students who perceive writing as a homogeneous, linear and predictable activity. Learners are therefore more likely to realize that learning to write is not simply learning to do one thing, but many things, including planning, revising, rewriting and being ready at all times to

adjust one's efforts and strategies in order to solve problems. The traces provided by VSC make all these steps perceptible and therefore easier to teach and study.

(c) Modelling

To show and "tell," make the writing process explicit

The data show that instructors like the permanence of the VSCs and the ability to archive them and show them at a later date. These attributes are also a useful feature for researchers and instructors. A collection of VSCs can be assembled, offering a host of authentic sequences from experts and novices that can serve as models and learning tools. These VSCs stand out because of their authenticity and detailed representation of writing processes. They can be used to model and explain these processes and to encourage users to think about the strategies and behaviours observed and their effectiveness in relation to the results achieved in the final text.

(d) Feedback

To initiate a personalized dialogue with students about their writing processes

VSC provides interested instructors with new ways of communicating remotely with their students through the many methods currently available in the digital environment. The data underscore the usefulness perceived by instructors and students, especially the personalized dialogue they can have on the students' writing processes. In particular, the feedback that VSC facilitates can literally jump off the page and take new forms (audiovisual commentary), incorporating images, movements and the ability to explain "in person" the response to various aspects of the texts produced by students.

Recommendations

In this section, we offer some practical recommendations based on our findings. In particular, these recommendations take account of the technology's limitations, as identified by the two instructors and their students.

Support

With regard to the instructors, we have seen the importance they attach to training and guidance. Ideally, time should be scheduled well in advance of a planned activity for workshops and regular meetings with and between instructors. We see the value in creating a community of practice (Lave & Wenger, 1991) for sharing expertise, resources (such as user guides, assignment descriptions, etc.) and successful practices arising from the inclusion of VSC in a language course. The FSL instructor noted that "*it's not something we can easily do on our own*." She was referring to the need to communicate with people she can turn to for answers to questions and to help her students. In our opinion, social networks like Twitter and Edmodo are powerful technological monitoring tools that can be used in this context to facilitate this type of continuous training.

The instructors' perspective

Adopting a new technology is never risk-free or effortless (e.g., the risk of failing to master the tool or the need to revise or redesign assignments) and can be discouraging. A tolerance for uncertainty and risk are important attributes to develop. The introduction of a new technology must be consistent with the instructors' teaching philosophy, beliefs and style, as well as their personal preferences when it comes to choosing and using digital tools for technology mediated language teaching and learning. For example, we saw the fundamental value that both language instructors placed on introspective thinking by their students as *writers in action* and on their role as supporters of the L2 writing process.

The students' perspective

As in the case of the instructors, the students' personal preferences, experiences and goals significantly influence how the VSC tool can help better guide and support the development of their L2 writing skills. They too must learn to take risks and adapt to technology. Most students mastered the VSC technology. They enjoyed the opportunity to review and modify their writing process and to reflect on it out loud (without the web camera). They also welcomed multimodal feedback (with a web camera) from the instructor on their writing process and product. These students consider VSC "a good technological learning tool." To help them get their bearings in a new instructional approach and to lessen resistance, it is vital that instructors highlight the affordances of the technological tool in relation to the course objectives by explaining its purpose and utility. For optimal results, the assignments performed with VSC should be more explicit and precise than ever, combining clear instructions, complementary resources, models and evaluation checklists to help the students perform their VSC under optimal conditions for optimal results.

Transformation of the curriculum

The technological dimension that VSC contributes to a L2 writing course led the instructors to modify certain aspects of their courses. It is no longer simply a matter of adding a VSC component to the usual assignments. Integrating it requires a major overhaul of the instructor's curriculum. The instructor must be willing to modify or even drop certain elements to make room for new approaches and to guide and evaluate the educational task. Transforming the curriculum forces instructors to rethink their entire instructional approach which, with VSC, is geared to supporting the language learner in his/her process of becoming an autonomous *writer in action*. For learners, the objective is to also adapt to a new learning paradigm that demands adjustments.

Time

Time is a factor that should not be underestimated. Instructors are often short of time and must work long hours to accomplish an endless and varied series of daily tasks. Technology can be time-consuming, especially in situations of asynchronous exchanges, when the instructor must provide individual feedback to students. Ideally, instructors interested in innovating with a technology like VSC should be given the initial time required to learn to use it, redesign their instructional assignments and create supportive resources (checklists and specific instruction sheets) to make optimal use of the tool. This investment in time will necessarily result in positive, even liberating, professional spinoffs for instructors who commit to this technology. Moreover, they must develop effective strategies for their own use of VSC: brief and

spontaneous individual feedback, and feedback for the entire class which is using the writing process "models" they want to explore.

Locations

The varied situations and spaces in which instructors work can play an important role in the optimal integration of a new technology. For example, having access to a lab or not (or to computer workstations in the classroom) can make all the difference when introducing students to the technology or assigning them group tasks, for example. For students, the ability to work on their own computer at their own pace and in the comfort of their own homes can also have a positive impact on adopting a new technology like VSC. The classroom (with a multimedia podium) can be used to model certain writing processes and to discuss effective models (expert models) and less effective models (novice models), which can be informative for the students (Brand-Gruwel, Wopereis & Vermetten, 2005). One writing assignment performed individually at home can be presented in class, while another, started as a group in the lab, can be continued at home. The assignment must be mediated by technology in an instructional continuum that transcends physical space.

Possible applications of VSC

Beyond writing courses

As the instructors and students said, VSC holds potential not only for writing courses but also for other language courses. The FSL instructor mentioned the possibility of using this technological tool in her oral communication course. Similarly, the ESL instructor was considering the possibility of using VSC for an oral or reading comprehension course.

We know that VSC is already used in "flipped classrooms" (O'Flaherty & Phillips, 2015) because it can encapsulate lessons and concepts that instructors make available to students online, prior to a course, to ensure that class time (face to face) can be spent on discussion, more detailed learning and practice.

With this in mind, we believe that VSC offers opportunities for hybrid learning, i.e., a face-to-face and remote continuum (LeCoin & Hamel, 2014). This learning approach, facilitated by VSC, offers the following advantages:

- It is a means of achieving "high-impact learning" in "mixed environments."
- It increases modes of interaction, contexts and recipients.
- It is not limited to the evaluation of work in class.
- It encourages an introspective learning process.
- It constitutes a transformative experience for the students by eliciting critical thought on behaviour and changes (as *writers in action).*

Conclusion

As this report shows, the findings of our study have generated important theoretical and instructional findings concerning the writing processes and strategies of L2 students in university programs. Specifically, our results have demonstrated the possibility of equipping instructors and their students with a technological tool that allows them to visualize and review the decision-making processes involved in L2 writing. Furthermore, our research has laid the groundwork for developing and analyzing a digital database of VSCs produced by learners in action, a database that can be used over the long term to provide a practical illustration of good (and bad) habits of writers in authentic L2 writing situations.

Highlights, limitations and future goals

VSC is a technology that is worth exploring and using; its affordances are especially valuable in the context of second-language and literacy instruction. Its use has created an entire field of study based on interaction in technology-mediated learning situations (Chun, 2013; Fisher, 2007).

Our research aligns with these studies, encouraging discussion, through VSC, on the importance of promoting metacognitive thinking in learners (Vandergrift & Goh, 2012) and finding ways of modelling the thinking, practices and decisions that are central to the literacy practices that need to be developed in *writers in action.*

This research is nevertheless a case study whose scope and duration are bounded, and whose findings are necessarily limited in terms of their generalizability. However, the wealth of empirical data collected during the case study offers valuable insight into the writing process and the associated teaching and learning activities. These perspectives helped us formulate pedagogical recommendations for using VSC in a writing course that we consider valid and relevant to guiding learners through this complex process and increasing their autonomy. Of course, further research is needed to better understand the potential of technologies like VSC as means for studying and promoting a more dynamic and coordinated approach to the language skills and writing processes crucial to postsecondary instructional activities. In particular, research is needed on the standardization (Bax, 2011) of technologies like VSC used by instructors and students in a mediated learning context (language learning), a process that lies at the very heart of innovation in education.

References

Abdel Latif, M. M. (2009). Toward a new process-based indicator for measuring writing fluency: Evidence from l2 writers' think-aloud protocols. *Canadian Modern Language Review/La Revue canadienne des langues vivantes*, *65*(4), 531-558.

Barbier, M. L., & Spinelli-Jullien, N. (2009). Online tools for investigating writing strategies in L2. *German as a foreign language*, *2*(3), 23-40.

Bax, S. (2011). Normalisation Revisited: The Effective Use of Technology in Language Education. *International Journal of Computer-Assisted Language Learning and Teaching*, *1*(2), 1-15. doi: 10.4018/ijcallt.2011040101

Benson, P. (2001). *Teaching and researching: Autonomy in language learning*. Harlow: Longman.

Bertin, J. C., & Gravé, P. (2010). In favor of a model of didactic ergonomics. In J. C. Bertin, P. Gravé and J.-P. Narcy-Combes (eds.), *Second language distance learning and teaching: theoretical perspectives and didactic ergonomics* (pp. 1-36). Hershey, PA: IGI Global USA.

Brand-Gruwel, S., Wopereis, I., & Vermetten, Y. (2005). Information problem solving by experts and novices: analysis of a complex cognitive skill. *Computers in Human Behavior, 21*, 487-508.

Casanave, C. P. (2002). *Writing games: Multicultural case studies of academic literacy practices in higher education*. Mahwah, NJ: Lawrence Erlbaum Associates.

Chun, D. (2013). Contributions of tracking user behavior to SLA research. In P. Hubbard, M. Schulze and B. Smith (eds.), *Learner-Computer Interaction in Language Education. A Festschrift in Honor of Robert Fischer* (pp. 256-262). San Marcos, TX: CALICO.

Degenhardt, M. (2006). CAMTASIA and CATMOVIE: Two digital tools for observing, documenting and analyzing writing processes of university students. In L. V. Waes, M. Leijten and C. M. Neuwirth (eds.), *Writing and digital media* (pp. 180-188). Amsterdam: Elsevier.

Denzin, N. K., & Lincoln, Y. S. (2003). *Strategies of qualitative inquiry*. Second edition. Thousand Oaks, CA: Sage.

Desmet, P., & Mompean, A. R. (2010). Presentation: ELAO et production écrite: bilan et perspectives. *Revue française de linguistique appliquée*, *XV*(2), 5-8.

Dion, C. (2011). Tools to Enhance Second Language Writing Autonomy: Can we do things better? In D. Gardner (ed.), *Fostering autonomy in language learning* (chapter 6, pp. 64-76). Gaziantep, Turkey: Zirve University.

Duff, P. (2008). *Case study research in applied linguistics*. New York: Lawrence Erlbaum Associates.

Early, M. (2008). Second and foreign language education in Canada. In N. V. Deusen-Scholl and N. H. Hornberger (eds.), *Encyclopedia of Language and Education* (second edition, vol. 4, pp. 197-208). Boston, MA: Springer.

Escorcia, D., & Fenouillet, F. (2011). Quel rôle de la métacognition dans les performances en écriture? Analyse de la situation d'étudiants en sciences humaines et sociales. *Canadian Journal of Education/Revue canadienne de l'éducation*, *34*(2), 53-76.

Felix, U. (2005). Analysing recent CALL effectiveness research – Towards a common agenda. *Computer Assisted Language Learning*, *18*(1+2), 1-32.

Fenwick, T., & Parsons, J. (2009). *The Art of Evaluation*. Toronto: Thompson Educational Publishing.

Ferris, D., Brown, J., Liu, H., Eugenia, M., & Stine, A. (2011). Responding to L2 students in college writing classes: Instructor perspectives. *TESOL Quarterly*, *45*(2), 207-234.

Fischer, R. (2007). How do we know what students are actually doing? Monitoring students' behavior in CALL. *CALICO Journal, 20*, 409-442.

Flower, L., & Hayes, J. R. (1981). A cognitive process theory of writing. *College Composition and Communication*, *32*, 365-387.

Geisler, C., & Slattery, S. (2007). Capturing the activity of digital writing: Using, analyzing, and supplementing video screen capture. In H. A. McKee and D. N. DeVoss (eds.), *Digital writing research: Technologies, methodologies, and ethical issues* (pp. 185-200). Cresskill, NJ: Hampton Press.

Gerbault, J. (2010). TIC: Panorama des espaces d'interaction et de rétroaction pour l'apprentissage de l'écriture en langue étrangère. *Revue française de linguistique appliquée, XV*(2), 37-52.

Hacker, D. J., Dunlosky, J., & Graesser, A. C. (2009). *Handbook of metacognition in education*. New York: Routledge.

Hamel, M.-J. (2012). Testing aspects of the usability of an online learner dictionary prototype: A product and process-oriented study. *Computer Assisted Language Learning*, *25*(4), 339-365.

Hamel, M.-J. (2013a). Analyse de l'activité de recherche d'apprenants de langue dans un prototype de dictionnaire en ligne, *Alsic, 16*. Retrieved from http://alsic.revues.org/2613

Hamel, M.-J. (2013b). Questionnaires to inform user tests in CALL. *International Journal of Computer Assisted Language Learning and Teaching, 3*(3), 56-76.

Hamel, M.-J., & Caws, C. (2010). Usability Tests in CALL development: Pilot Studies in the context of the Dire autrement and FrancoToile projects. *CALICO Journal*, *27*(3), 491-504.

Hamel, M.-J., & Milicevic, J. (2007). Analyse d'erreurs lexicales d'apprenants du FSL. Démarche empirique pour l'élaboration d'un dictionnaire d'apprentissage. *Revue canadienne de linguistique appliquée*, *10*, 25-45.

Hayes, J. R. (2000). A new framework for understanding cognition and affect in writing. *Perspectives on writing: Research, theory and practice*, 6-44.

Hayes, J. R., & Flower, L. S. (1980). Identifying the organization of writing processes. In L. Gregg and E. R. Steinberg (eds.), *Cognitive processes in writing* (pp. 3-30). Hillsdale, NJ: Erlbaum.

Huh, K., & Hu, W. (2005). Criteria for effective CALL research. In J. L. Egbert and G. M. Petrie (eds.), *CALL Research Perspectives* (pp. 9-24). New York: Lawrence Erlbaum Associates.

Hyland, K. (2000). *Disciplinary discourses: Social interactions in academic writing*. New York: Longman.

Kovacs, B., Gaunet, F., & Briffault, X. (2004). *Les techniques d'analyse de l'activité pour l'IHM*. Paris: Lavoisier.

Lantolf, J. P. (2006). Sociocultural theory and L2: State of the art. *Studies in Second Language Acquisition*, *28*(1), 67-109.

Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation*. New York: Cambridge University Press.

Lecoin, I., & Hamel, M.-J. (2014). Dispositif hybride pour un cours de grammaire en français langue seconde. *International Journal of Technologies in Higher Education/Revue internationale des technologies en pédagogie, 11*(1), 35-49.

Leijten, M. (2013). Keystroke Logging in Writing Research: Using Inputlog to Analyze and Visualize Writing Processes. *Written Communication*, *30*(3), 358-392.

Leki, I., Cumming, A. H., & Silva, T. (2008). *A synthesis of research on second language writing in English*. New York: Routledge.

Leon, K., & Pigg, S. (2011). Graduate students professionalizing in digital time/space: A view from "down below." *Computers and Composition*, *28*(1), 3-13.

Little, D. (2007). Language Learner Autonomy: Some fundamental considerations revisited. *Innovation in Language Learning and Teaching*, *1*(1), 14-29.

Lunsford, A. A. (2006). Writing, technologies, and the fifth canon. *Computers and Composition*, *23*(2), 169-177.

Matsuda, P. K. (2003). Second language writing in the twentieth century: A situated historical perspective. In B. Kroll (ed.), *Exploring the dynamics of second language writing* (pp. 15-34). New York: Cambridge University Press.

Matsuda, P. K. (2013). Response: What is second language writing? And why does it matter? *Journal of Second Language Writing*, *22*(4), 448-450.

Miller, K. S., Lindgren, E., & Sullivan, K. P. H. (2008). The psycholinguistic dimension in second language writing: Opportunities for research and pedagogy using computer keystroke logging. *TESOL Quarterly*, *42*(3), 433-454.

Negretti, R., & Kuteeva, M. (2011). Fostering metacognitive genre awareness in L2 academic reading and writing: A case study of pre-service English instructors. *Journal of Second Language Writing*, *20*(2), 95-110.

Nogier, J.-F. (2008). *Ergonomie du logiciel et design Web: Le manuel des interfaces utilisateur*. Fourth edition. Paris: Dunod.

O'Flaherty, J., & Phillips, C. (2015). The use of flipped classrooms in higher education: A scoping review. *The Internet and Higher Education*, *25*, 85-95.

Park, K., & Kinginger, C. (2010). Writing/thinking in real time: Digital video and corpus query analysis. *Language Learning and Technology*, *14*(3), 31-50.

Raby, F. (2005). A user-centered ergonomic approach to CALL research. In J. L. Egbert and G. M. Petrie (eds.), *CALL Research Perspectives* (pp. 179-190). New York: Lawrence Erlbaum Associates.

Raimes, A. (1985). What unskilled ESL students do as they write: A classroom study of composing. *TESOL Quarterly*, *19*(2), 229-258.

Ravelli, L., & Ellis, R. A. (2004). *Analysing academic writing: Contextualized frameworks*. New York: Continuum.

Ricento, T., & Cervatiuc, A. (2009). Language minority rights and educational policy in Canada. In J. E. Petrovic (ed.), *International Perspectives on Bilingual Education: Policy, Practice and Controversy* (pp. 21-42). Charlotte, NC: Information Age Publishing.

Séror, J. (2013). Screen capture technology: A digital window into students' writing processes/Technologie de capture d'écran: une fenêtre numérique sur le processus d'écriture des étudiants. *Canadian Journal of Learning and Technology/La revue canadienne de l'apprentissage et de la technologie*, 39(3), 1-16.

Séror, J. (2012). Show me! Enhanced feedback through screencasting technology. *TESL Canada Journal*, 30(1), 104-116.

Séror, J. (2009). Institutional forces and L2 writing feedback in higher education. *Canadian Modern Language Review, 66*(2), 203-232.

Silverman, D. (2006). *Interpreting qualitative data: Methods for analyzing talk, text and interaction*. Third edition. Thousand Oaks, CA: Sage.

Smith, J. G., & Smith, R. L. (2012). Screen-capture instructional technology: A cognitive tool for designing a blended multimedia curriculum. *Journal of Educational Computing Research*, *46*(3), 207-228.

Spack, R. (2004). The acquisition of academic literacy in a second language: A longitudinal case study, updated. In V. Zamel and R. Spack (eds.), *Crossing the curriculum: Multilingual learners in college classrooms* (pp. 3-45). Mahwah, NJ: Lawrence Erlbaum Associates.

Spelman Miller, K. (2005). Second language writing research and pedagogy: A role for computer logging? *Computers and Composition, 22*(3), 297-317.

Stapleton, P., & Radia, P. (2009). Tech-era L2 writing: towards a new kind of process. *ELT Journal*, *64*(2), 175-183.

Thompson, R., & Lee, M. J. (2012). Talking with students through screencasting: experimentations with video feedback to improve student learning. *The Journal of Interactive Technology and Pedagogy, 1*(1).

Thumb, J. (2004). *Dictionary look-up strategies and the bilingualised learner's dictionary: A think-aloud study*. Tübingen: Max Niemeyer Verlag.

Van Waes, L., & Schellens, P. J. (2003). Writing profiles: The effect of the writing mode on pausing and revision patterns of experienced writers. *Journal of Pragmatics*, *35*(6), 829-853.

Vandergrift, L., & Goh, C. C. M. (2012). *Teaching and learning second language listening*. New York: Routledge.

Varantola, K. (2002). Use and usability of dictionaries: Common sense and context sensibility? In M. H. Corréard (ed.), *Lexicography and Natural Language Processing. A Festschrift in honour of B. T. S. Atkins* (pp. 30-44). Stuttgart: SUP.

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Cambridge: Harvard University Press.

Wengelin, Å., Torrance, M., Holmqvist, K., Simpson, S., Galbraith, D., Johansson, V., et al. (2009). Combined eyetracking and keystroke-logging methods for studying cognitive processes in text production. *Behavior Research Methods, 41*(2), 337.

Woods, D. K., & Dempster, P. G. (2011). Tales from the bleeding edge: The qualitative analysis of complex video data using Transana. *Forum: Qualitative Social Research*, *12*(1).

Zimmerman, B. J., & Schunk, D. H. (2001). *Self-regulated learning and academic achievement: Theoretical perspectives*. Second edition. New York: Routledge.

Higher Education Quality Council of Ontario

An agency of the Government of Ontario