COLLABORATIVE WRITING AMONG SECOND LANGUAGE LEARNERS IN ACADEMIC WEB-BASED PROJECTS

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This study investigates Web-based, project oriented, many-to-many collaborative writing for academic purposes. Thirty-eight Fulbright scholars in an orientation program at a large Midwestern university used a Web-based word processing tool to collaboratively plan and report on a research project. The purpose of this study is to explore and understand the changing nature of collaborative writing, as it is influenced by Web-based writing contexts. Details of students' writing processes and their perceptions of the collaborative Web-based word processing experience are explored. Findings suggest that students focused more on meaning than form, that their grammatical changes were overall more accurate than inaccurate, that they participated with varying frequency, and that they used the tool for simultaneous varied purposes. Student feedback about the Web-based collaborative activity and use of Google Docs offers additional insights. Observations about the evolving nature of Web-based collaborative writing and associated pedagogical practices including considerations about student autonomy are discussed.

Keywords: Collaborative Learning, Computer-Assisted Language Learning, Discourse Analysis, Learner Autonomy

INTRODUCTION

Collaborative practices are being increasingly advocated in second language classrooms largely in response to the collaborative potential of Web 2.0 tools. The literature reveals a noticeable increase in interest in collaborative writing (e.g., Arnold, Ducate, & Kost, 2009; Elola & Oskoz, 2010; Kessler, 2009; Kessler & Bikowski, 2010; Storch, 2005). However, few collaborative writing projects, particularly involving more than two writers, are actually undertaken, and these types of projects have received little research (Storch, 2005). In particular, research on students' perceptions of collaborative writing projects, "the nature of the [collaborative] writing process and of the written text produced" has received "scant attention" (Storch, 2005, p. 155). In fact, most of the research on collaborative writing is focused on texts produced for preparatory writing assignments and not on more extensive texts meant to stand on their own (Storch, 2005). As Storch (2005) notes, "To truly prepare students for collaborative writing may require a re-conceptualization of classroom teaching" (p. 169). Further, there is heretofore no research on collaborative writing with Web-based word processing in L2 contexts. The low number of collaborative writing projects and the restriction to pair work is likely due to logistical or environmental considerations such as face-to-face and online contexts where a single document is written by one student, then distributed to another student, and then returned to the original student for review. This sharing of a single original document requires students to work at the convenience of their partners. With newer technologies available, however, learners can more easily work in groups of three or more simultaneously. Newer technologies allow researchers insight into the L2 collaborative writing process and an increased understanding of how these technologies may affect the collaborative writing process. This study aims to fill the needs addressed above and understand the collaborative writing process involving more than two non-native English speaking writers working within a shared Web-based document.

Collaborative Writing: Theoretical Bases, Benefits, and Concerns

The literature has noted many benefits of collaborative writing. The theoretical basis for these projects largely rests on the work of Vygotsky (1978) with his emphasis on the role of social interaction in learning and on the concepts underlying the communicative approach in L2 learning. Hirvela (1999)

expands on the importance of social interaction when he notes that collaborative writing provides opportunities for students to write as part of a community and use each other for support and guidance. Collaborative and/or pair writing in both L1 and L2 settings has been recognized as contributing to a higher quality of writing (Storch, 2005); a better sense of audience (Leki, 1993); increased pooling of knowledge (Donato, 1994) and ownership (Storch, 2005) in the writing process; increased student motivation (Kowal & Swain, 1994; Swain & Lapkin 1998); and attention to discourse structures as well as grammar and vocabulary usage (Swain & Lapkin, 1998). Storch (2005) also notes the importance of immediate feedback for optimal collaborative writing to occur.

However, collaborative writing projects do not always succeed. This can be due to inexperience, interpersonal conflict, concerns of fairness (Chisholm, 1990), and concerns of inaccurate peer edits (Nelson & Murphy, 1993). Also, students may ultimately view the process of writing as a private act (Ede & Lunsford, 1990; Murray, 1992). Thus, the role of the individual writer in a collaborative writing project is not yet understood. Yet with technologies that allow many-to-many simultaneous or near simultaneous writing, greater accountability for participation in the writing process, and improved document sharing, it is likely that the number of projects involving collaborative writing with three or more writers will grow in the future. Of interest to researchers will be how these abilities that technologies afford may affect the process of collaborative writing itself.

Collaborative Writing with Technology

A search of the literature reveals that technology has influenced the writing process and practices in many ways. Discussion about technology and writing can be traced to the transition from pen to word processing (Pennington, 1991); then from word processing to the networked writing classroom (Ogata, Yano, & Wakita, 1998), online electronic portfolios (Kahtani, 1999) and writing in text-based virtual environments such as MOOs (Turbee, 1999); and to writing and email (Bloch, 2002; Liaw, 1998). Using technology for writing was seen as helping students see writing as fluid and dynamic and helping them focus more on the meaning in their papers early on as opposed to focusing excessively on form (Wresch, 1984). With the newer technologies, collaborative writing often takes place within discussion boards, online chats, email communication, or wikis. These forms of communication offer students timely help in their writing when they most need it (Parks, 2000). With such a great amount of collaboration, issues of ownership and authorship have also been examined.

Examining discussions in a wiki, Hunter (2011) found that the online collaborative environment is helping redefine contributors' ideas of authorship. He finds that collaborative writing is more successful when the writers share "common 'habits of mind'" and when contributors hold less "author-centric perspectives of textual ownership" (p. 40). Characteristics of wikis cited as leading to this redefinition of authorship and ownership include the ease with which collaborators can work together and the large number of people who can contribute, resulting in increased critical thinking in the collaborative writing process. In her analysis into collaborative writing and authorship, Spigelman (2000) concludes that successful collaborative writing groups view the collaborative writing process as a social activity involving knowledge construction with team mates who are willing to trust each other with co-ownership. This social constructionist perspective acknowledges the tension between the solitary act of writing and the need for notions of ownership that are both public and private. In all of these situations, the influence of the technology on the writing produced is discussed.

These findings suggest that the process of collaborative writing will likely be affected by technology as well. Newer technologies may benefit collaborative writing by allowing more convenient feedback and revision and a faster response time, potentially increasing motivation and creativity (Lam & Pennington, 1995). Newer technologies also allow students to work on the text simultaneously, and the text is always available to all users. In spite of the advantages, the role of the technology itself is seen as secondary to how it is used: "The degree of success of any application of word processing in an ESL setting will

ultimately be determined by the nature of the users and the circumstances of use, rather than directly by the attributes of the medium" (Pennington, 1991, p. 267). Lam and Pennington (1995) also noted that teachers using new technology must be patient in order to give students and instructors sufficient time to adapt to the technology and "innovative teaching strateg[ies]" that will arise (p. 65). Many of the advances to be noted in technology currently are those in the realm of Web 2.0.

Current research in writing using Web 2.0 tools has investigated how these technologies provide new opportunities for students "to engage in the writing process and display their finished products" (Hoopingarner, 2009, p. 228). Many have recognized that students tend to communicate online in unpredictable ways (Belz, 2007; Fischer, 2007), focus on meaning rather than form (Kessler, 2009), demonstrate improved fluency and accuracy (Elola & Oskoz, 2010), and value the opportunity to share feedback with peers (Ware & O'Dowd, 2008). Also, technologies that allow many-to-many communication influence collaborative writing in how writers may plan and engage in collaborative tasks (Kessler, 2009). These technologies can also contribute to students' sense of ownership and to their sense of autonomy (Kessler, 2009). This area of individual autonomy within collaborative writing is one that is receiving more attention in research, due largely to the increasing ease of these assignments made possible by the technology of Web-based word processing and to the research opportunities this technology provides (Kessler & Bikowski, 2010). Kessler (2009) notes that the amount of teacher intervention and student autonomy in collaborative writing projects can influence the writing and as such should be considered carefully.

Greene (2000) observed a decade ago that theories for using technology in the writing class were as of yet underdeveloped. Yet some theories and models are emerging. This study is informed by the cultures-of-use analysis of Activity Theory (Thorne, 2003). Drawing from cultural-historical learning theory, this framework relies upon artifacts which, "embody historical processes that shape, and are shaped by, human activity" in an attempt "to render artifacts as they exist for users" (p. 40). This approach recognizes the influence of cultural practices and histories of use upon functionality of artifacts. Cultural practices comprise global and local characteristics as well as established and emergent qualities. This model allows us to reflect on the culture-of-use that emerges within a particular context such as online collaborative environments. To further explore how the environment affects writing, Kessler and Bikowski (2010) proposed a framework for promoting collaborative language learning abilities in computer mediated contexts. This framework can be used to address Storch's (2005) call for more research into understanding the collaborative writing process. As the nature of Web-based many-to-many collaborative writing evolves, students will need to find their place in this writing process. Kessler and Bikowski's model provides insight into helping students navigate these collaborative efforts that are often considered private acts, specifically focusing on how they negotiate the concept of autonomy in collaborative spaces. The framework assumes that, "Autonomy as a collaborative learner depends on (a) the ability to use language to independently contribute personal meanings as a collaborative member of a group; (b) the ability to use appropriate strategies for communicating as a collaborative member of a group; and (c) the willingness to demonstrate these abilities within the group" (p. 53). Thus, while individual contributions to the group project are important, noting how the contributions are made to the group (including the use of interactive technologies) is valued, as are group communication strategies and an interest in group performance. Crucial in this framework is how technology may influence the learner, the process, and the pedagogy.

Thus, a review of the literature reveals that collaborative writing in the L2 writing classroom is advocated though underutilized, that there is a history of how technology has impacted the L2 collaborative writing process, and that technology provides many benefits to the L2 collaborative writing process. Yet, more research is needed on the nature and process of collaborative writing and learners' perceptions of the collaborative writing process (Storch, 2005). Even less work has been published on collaborative writing in Web-based word processing (though, see Kessler, 2009, and Kessler & Bikowski, 2010) and how

learners navigate writing in this context. This study aims to fill these needs by exploring the changing nature of Web-based collaborative writing within these environments.

Specifically, the study focuses on the following research questions:

1. How do L2 students engage in the collaborative writing process using Web-based word processing tools?

2. What is the nature of group participation in Web-based collaborative writing?

MATERIAL AND METHODS

In order to understand students' collaborative writing behavior within Web-based word processing, the researchers analyzed group collaborative texts produced in Google Docs. Google Docs includes functionality that is similar to a number of emerging Web-based word processing tools, including simultaneous editing ability and automated updating. Students' activity within their team was initially analyzed in order to determine to what degree students participated in the collaborative writing process. Students' writing and use of the Web space was then categorized according to their revision and participation activity. This analysis sheds light on how the students wrote collaboratively within this context. The researchers also conducted a survey at the end of the course to gather students' perceptions of collaborative writing in this environment and their frequency of participation (see Appendix). Questions on the survey focused on their experience participating as a member of a group in these projects, how often they used the Web-based word processing tool, and feedback for using it for collaborative writing projects.

Participants

Thirty-eight Fulbright scholars in a pre-academic orientation program at a large Midwestern university participated in this study. This group included three sections of an English for Academic Purposes (EAP) class, the focus of which was to prepare students for the academic research, writing, and presentation skills of the US academic community. All of these students had scored above 550 on the paper-based TOEFL test and had been accepted into graduate programs through Fulbright scholarships. They were from a wide range of disciplines. This pre-academic program preceded entry into their academic programs. Instructors served as facilitators, helping students achieve course goals while allowing them flexibility in how they approached tasks. Students worked in small groups of three to four members for three weeks (12 class hours a week with additional outside work) to design, implement, write up, and present a primary research project. This study involved observing the writing process that student teams engaged in as they developed their projects.

For the EAP course project, students grouped themselves according to academic interests. They were shown previous papers written by students in the courses and guidelines regarding topics were given, including encouraging the students to consider time restrictions, data availability, and research methods knowledge. Topics needed to be cleared by the instructors before the projects began. Students then planned their project and used faculty as advisors. No specific writing process model was given to the students to follow. The projects needed to involve both primary research (qualitative or quantitative) and secondary sources. Class time consisted of time for lecture/discussion on finding and narrowing a topic, research methods, data collection and analysis, organization, clarity in sentence structure, advanced grammar, using sources, citation styles, and presenting research orally. Teams gave in-progress presentations of their work during the course and received feedback from peers and the instructors. Other class time was reserved for teams to go to the library, collect data, discuss their project, or go to a computer lab. Teams re-convened at the end of class time to de-brief and plan for the next class meeting. Other courses were offered to the students during this three-week period as well, including ESL courses in grammar, listening, using sources without plagiarizing, and presenting. Since this program was

voluntary for the students and not part of their graduate coursework, no grades were given in any part of the project or courses.

For this research, participant groups were chosen for case study analysis. This decision to limit the data was made due to the abundance of data recorded throughout the revision process. Thus, three groups were randomly chosen for a more in-depth study of their collaborative writing, and a portion of each team's writing was analyzed. A randomly-chosen 10% of the saved versions in each of the three team's Google Docs texts was analyzed. Each iteration is an automatically saved and automatically numbered version (every 11 seconds) of the document; thus, an iteration could be a change to a word, sentence, paragraph, and so forth. The iterations to be used were identified using a random number generator (http://www.random.org/integers). This came to a total of 474 iterations that were analyzed.

The three groups that were chosen for analysis of their collaborative writing included a total of nine students: one each from Cameroon, Germany, Guatemala, Nicaragua, and Russia, and two from Ukraine and Mexico. The topics the three groups chose for their projects were the "Integration of graduate Fulbright students into a university community," "Changes in human behavior/thinking after becoming a parent: The influence of gender," and "The use of digital library databases by graduate students." Early in the program students were introduced to Google Docs as a potential context for them to do their projects. They were also given the option of using Microsoft Word; however, all groups chose to use Google Docs in order to collaboratively write up their research. No students had previously used Google Docs for collaborative projects. During the course any questions regarding the use of the software were answered. These students were trained on the features of Google Docs including how to create, name, and save documents; how to view and maneuver in the revision history; and how to change font formatting. Once the data was collected, it was analyzed.

Data Collection and Analysis

Contributions to the Web-based word processing document were categorized based on the revision activity observed. While these types of contributions have been defined in various ways previously (e.g., Brock & Pennington, 1999; Raimes, 1985) for the purposes of this study the coding protocol emerged during data analysis with the codes reflecting the observed action of the writer. The researchers observed that two types of contributions were occurring: those that affected the language itself and those that did not affect the language used. Six total codes were then identified, with three being related to language use and three being unrelated to language use. The quality of the papers themselves was not evaluated holistically, as it was not in the scope of this study. Two trained Linguistics graduate students then coded the 474 iterations using the coding scheme developed by the researchers. Inter-rater reliability was calculated at 0.95 using a paired samples t-test.

These two types of contributions were identified as either *language related contributions* (LRCs) or *non-language related contributions* (NLRCs). LRCs refer to the contributions that involved language use in some way, such as adding or moving text or making changes in form. Non-language related contributions refer to behavior such as student discussions or changes in formatting or style. Categorizing the students' writing with these LRCs and NLRCs provided for a clean and clear analysis. The language-related contributions were identified as attending to form, meaning, or other. Each of these types is explained in Table 1.

Table 1. *Language Related Contribution Types, Descriptions, and Examples*

Contribution Type	Description	Examples
Form	Changes made in capitalization, part of speech, pluralization, pronouns, punctuation, spacing, spelling, or tense	• Change from "literary" to "literature" • Change from "he" to "we" • Change from a period to a comma • Change from "theother" to "the other" • Change from present to past tense
Meaning	Text that contributes meaning to the paper added, deleted, or replaced	Replacement: "This fact will help all of us to integrate successfully in the community at our host university and to improve ourselves and our points of view on ~~many~~ **different** topics." *Note: "many" was replaced by "different"*
Other	Text that does not contribute to meaning added, deleted, moved, or replaced	• Deleting the stand-alone phrase "~~structure of our project.~~" from the end of the paper • Moving "The questionnaire was send to" from one location in the sentence in to another

It can be seen in Table 1 that there were eight types of *form* LRCs: contributions in capitalization, part of speech, pluralization, pronouns, punctuation, spacing, spelling, and tense. Fewer types of language related contributions in *meaning* were found: adding, deleting, or replacing text. For a contribution to be categorized as a *meaning* LRC, the change to the collaborative text had to have affected the meaning of the paper. For example, adding new text or deleting novel text and not moving it elsewhere in the document were both categorized as *meaning* LRCs. *Other* LRCs, however, were contributions that students made that did not affect meaning or form. For example, when a student moved a phrase within a sentence and the change did not result in a different meaning or result in a change in form, it was identified as an *other* LRC. *Other* LRCs included four types: adding, deleting, moving, and replacing text. *Other* LRCs reflects changes students made to language as they revised and fine-tuned the document but without changing meaning. In addition to the three contribution types of LRCs discussed above, students also made non-language related contributions.

Table 2 provides detail on non-language related contributions. The three types of NLRCs found were in formatting, planning, and non-project communication.

In Table 2 we see that there are four types of *formatting* NLRCs: changes made in the formatting of the date, the text, and indentation. Given that none of these changes affected meaning, they were categorized as NLRCs. Four types of *planning* NLRCs were also found: planning text being added, deleted, moved, or replaced. In this type of NLRC, the writers' contributions related to planning the organization of the document, the division of the workload, or meeting times. Finally, in contributions that were identified as *non-project communication*, two types of contributions were found: adding or deleting text that was not related to the project. Examples include discussions of social plans or messages for friends. The information in Tables 1 and 2 was used to analyze the 474 iterations from the three Web-based team collaborative writing projects.

Table 2. *Non-Language Related Contribution Types, Descriptions, and Examples*

Contribution Type	Description	Examples
Format	Changes made in date formatting, text formatting, or indentation	• Change from "January 4, 2009" to "4 January 2009" • Making the font size bigger • Change from a bulleted to a numbered list
Plan	Project planning text added, deleted, moved, or replaced	Adding planning text: "next things we'll discuss together, because all the rest seems very important and quite short for me, and about all the features we are going to discuss."
Non-Project communication	Text that serves as communication for non project-related purposes added or deleted	Adding a message about an event not related to the project

An eight-question survey using both Likert-scale and open-ended questions was also conducted at the end of the course to gather students' perceptions of collaborative writing in this environment, their feedback on using Google Docs, and their frequency of participation. All 38 students chose to complete the survey. The results of this survey can be found in the Appendix.

RESULTS

This study seeks to understand how L2 students engage in the collaborative writing process using web-based tools. Results focus on the three case study teams' individual member participation and construction of texts regarding their language and non-language related contributions.

Participation within Teams

The extent to which each member of a team contributed was observed. Table 3 shows that all students participated in the collaborative writing project and that each team had a member who assumed 45-50% of the activity workload, while a second teammate was responsible for 30-40%, and the third contributed 15-25%.

Table 3. *Number and Percent of Language Related Contributions and Non-Language Related Contributions made by Team Members*

	Team One	Team Two	Team Three
	No. (% of Team) of LRCs and NLRCs	No. (% of Team) of LRCs and NLRCs	No. (% of Team) of LRCs and NLRCs
Teammate 1	97 (46% of team)	90 (46% of team)	32 (48% of team)
Teammate 2	79 (37% of team)	58 (30% of team)	23 (35% of team)
Teammate 3	36 (17% of team)	48 (24% of team)	11 (17% of team)

This table shows that regardless of the number of contributions made per team, the percent of participation by individual team members fell into three levels. While interpreting this data, it is important to note that Web-based word processing tools provide information about individual contributors and

changes made. It is not possible to determine from this information if two or more students were sitting at the same computer making changes together.

Language and Non-Language Related Contributions

Next, the students' language-related contributions and non-language related contributions to their projects were categorized according to the information provided in Tables 1 and 2. Frequency of use of these contributions was observed. The unit of analysis was each student contribution. Table 4 provides an overview of this use by team.

Table 4. *Language Related Contributions and Non-Language Related Contributions by Team*

	Team One	Team Two	Team Three	Totals (Teams 1-3)	Action (% of Total)
Student Action					
Language Related Contributions					
Meaning	131	93	40	264	55.70%
Other	25	35	4	64	13.50%
Form	29	27	7	63	13.29%
Non-Language Related Contributions					
Formatting	16	17	11	44	9.28%
Plan	10	23	4	37	7.81%
Non-project communication	1	1	0	2	0.42%
Totals of LRCs and NLRCs	212	196	66	474	100.00%

As can be seen in Table 4, language related contributions occurred much more often than did non-language related contributions (82% LRCs and 18% NLRCs). *Meaning* LRCs were the most common across all groups, representing over half of all the contributions made.

Language Related Contributions

Moving from all LRCs and NLRCs to a closer look at each contribution type provides information on the students' writing behavior. Attention to *meaning* was the most common category found, including 57% of all contributions.

We can see that while groups varied in frequency of contributions overall, each of the groups focused upon *meaning* LRCs. These include adding, deleting, and replacing text. Following are examples of each of these.

Table 5. *Attention to Meaning (Language Related Contribution)*

	Team One	Team Two	Team Three	Totals (Teams 1-3)	Action (% of Total)
Student Action					
Text added	81	49	21	151	57.20%
Text deleted	35	26	15	76	28.79%
Text replaced	15	18	4	37	14.01%
Total Meaning	131	93	40	264	100.00%

This *meaning* LRC *text added* example involves the addition of a sentence that is a part of the main body of text and contributes to meaning. The added text is in bold:

> "This fact will help many people to integrate **easier into the group, no matter which cultural background**" [team 1, iteration 1230].

A *meaning* LRC *text deleted* involves a deletion that affected meaning. In the following example, when a student deleted a word the meaning was changed from being more general to more specific:

> "It is important to admit, that current research is determined by such fields of study as: ~~general and~~ family psychology and sociology" [team 2, iteration 568].

The second most frequent contribution was the LRC *other*. This refers to student revisions that did not focus upon form or meaning. An example of *other* would be a student moving a phrase within a sentence or deleting a redundant word. The results of this can be seen in Table 6.

Table 6. *Other (Language Related Contribution)*

	Team One	Team Two	Team Three	Totals (Teams 1-3)	Action (% of Total)
Student Action					
Addition	12	20	3	35	54.69%
Deletion	6	8	0	14	21.87%
Move	4	6	1	11	17.19%
Replacement	3	1	0	4	6.25%
Total Other	25	35	4	64	100.00%

Among students' use of the LRC *other,* the category of *addition* was the most common across all teams, with *replacement* being the least common. Students moved text around nearly as often as they deleted it. Students demonstrated autonomous abilities by making contributions illustrating the preparation, planning, and recursive revision aspects associated with process-based writing.

One aspect of the process of writing involves collective scaffolding, as described by Storch (2005). Instances of two or three students revising the same text simultaneously occurred within the teams.

Exploring how students simultaneously build on each other as a resource allows for greater understanding of the types of changes they make as they write collaboratively. In one instance [team 1, revisions 46-48], a student wrote a four-sentence paragraph, another student removed the final sentence, and a third student re-inserted a portion of text using the review revision history interface. This all happened within 2 minutes. After this re-insertion, no more changes were made. This example illustrates how the revision history feature of Google Docs allowed students to see previous text and choose to re-introduce it to the document.

Figure 1 illustrates collective scaffolding [team 2, revisions 150-170]. One student's changes are underlined and another's changes are italicized. The students collectively produced grammatically correct phrasing for the question they desired. Within 14 iterations they were able to do so.

150:	<u>**The**</u> reasons that affect change in behavior after becoming a parent?
151:	*Do really* reasons that affect change in behavior after becoming a parent?
153:	*Do really* reasons that affect change in behavior after becoming a parent?
155:	<u>**The**</u> reasons that affect change in behavior after becoming a parent?
156:	<u>**Do really**</u> reasons that affect change in behavior after becoming a parent?
157:	*Are excist* reasons that affect change in behavior after becoming a parent?
158:	<u>**Do really**</u> reasons that affect change in behavior after becoming a parent?
159:	<u>**Are excist**</u> reasons that affect change in behavior after becoming a parent?
160:	*Are* reasons that affect change in behavior after becoming a parent?
162:	<u>**Do really**</u> reasons that affect change in behavior after becoming a parent?
163:	<u>**Are**</u> reasons that affect change in behavior after becoming a parent?
168:	*What are the* reasons that affect change in behavior after becoming a parent?
169:	<u>**Are**</u> reasons that affect change in behavior after becoming a parent?
170:	<u>**What are the**</u> reasons that affect change in behavior after becoming a parent?

Note: missing lines represent automatically saved iterations that include no data changes

Figure 1. Example of collective scaffolding.

This type of simultaneous editing is not possible in traditional desktop word processing programs, wikis, or other synchronous tools where the user must wait for interlocutors to complete their turns before they have access to each other's text. In Google Docs users see their collaborators' text appear as it is being written. Unlike the observations made by Storch (2005) where students orally pooled their collective linguistic knowledge to offer alternative suggestions in order to produce a written text, in this simultaneous word processing context students make written alternative suggestions within the text itself. This interaction results in an increase of textual production as opposed to oral production, an increase in opportunities for practice in writing, and experimentation with alternative phrasings within the full context of the text.

Table 7 provides an overview of attention to *form*. It can be seen that the most common LRC in this was changing spelling (38.10% of the total), followed by changing punctuation (20.63% of the total). The least common contribution type in attention to *form* was changing verb tense (1.59% of the total).

Table 7. *Attention to Form (Language Related Contribution)*

	Team One	Team Two	Team Three	Totals (Teams 1-3)	Action (% of Total)
Student Action					
Capitalization changed	3	3	0	6	9.52%
Part of speech changed	1	0	2	3	4.76%
Plural changed	2	1	2	5	7.94%
Pronoun changed	2	0	0	2	3.17%
Punctuation changed	3	9	1	13	20.63%
Spacing changed	6	3	0	9	14.29%
Spelling changed	11	11	2	24	38.10%
Tense changed	1	0	0	1	1.59%
Total Form	29	27	7	63	100.00%

In addition to analyzing the types of contributions students made in attention to *form*, the accuracy of those contributions was also observed. The results are presented in Table 8.

Table 8. *Accuracy when Attending to Form*

Type of change	Correct (Team 1/2/3)	Incorrect (Team 1/2/3)
Capitalization	1/1/0	2/2/0
Part of Speech	1/0/2	0/0/0
Plural	2/0/2	0/1/0
Pronoun	2/0/0	0/0/0
Punctuation	1/7/1	2/2/0
Spacing	6/3/0	0/0/0
Spelling	8/10/2	3/1/0
Tense	1/0/0	0/0/0
Total	50 (79%)	13 (21%)

It can be seen that overall changes were correct. The contribution type with the most incorrect changes was capitalization, where out of a total of seven changes, five were done incorrectly. For some contribution types, however, changes were always correct (e.g., part of speech, pronouns, spacing, and tense).

Examples of these changes follow. In the first, a part of speech is correctly changed from an adjective to a noun ("literary" to "literature"):

> "The cultural background seemed to be not so important, like stated in the common
> lit~~rary~~**erature**." [team 1, iteration 1189]

In the following example of an inaccurate contribution, the spelling of a heading is incorrectly changed when the final letter is removed:

"A. Introduction" [team 2, iteration 603]

These examples illustrate the type of changes that were made in attention to *form*. Students also made contributions within their texts that were not related to language.

Non-language Related Contributions

Information was also analyzed regarding non-language related contributions, such as how students used the Web-based processing tool to plan the creation and organization of their text. An example of a plan is offered below. In this exchange, students were using the environment to chat about administrative tasks and a list was constructed that served as a meta-discussion about the document as it neared completion. The students wrote it in the color red and in a larger font size for the beginning comments. This font change allowed the team members to separate their plan from their content so that they could simultaneously plan collaboratively in the same space as they actually created their final document [team 1, begun in iteration 1235]. This can be observed in Figure 2.

- I have finished the bibliography! I just don't know how to insert citations on websites in the text! and I the space between lines 5-6-7 - I think we should change them in Word format?
- yes i already did it, write (www.xxxxx.com) and we will ask her today again
- ok!
- we have already 13 pages without discussion!!!!
- I'll try to look through the introduction and cut smth!
- we make it then together, because i already copy it in the word document or you make the pieces you want to cut red, so I can see
- ups, I've already cut some sentences and began to change some
- ok then I delete it again and copy it when you are here.
- I marked with red, what I deleted
- ok
- next things we'll discuss together, because all the rest seems very important and quite short for me, and about all the features we are going to discuss. by the way, maybe, you need smth to print? I am in the library and already printed introduction for myself .
- no thank you

Figure 2. Example of Planning Within Document.

Figure 2 illustrates how students experimented with the tool as they established a shared understanding of ways they could collaborate within it. It also sheds light on some of the processes students used in their collaborative writing while in different locations—we can see that they felt that some topics warranted in-person discussion, while others could be resolved online. Insight into L2 learners' collaborative writing process can show us how they give feedback to each other, what they seek for help from each other, and how they share strategies in handling writing concerns (e.g., how to mark a missing citation).

As students used this Web-based word processing tool, they engaged in a number of language related contributions (form, meaning, and other) and non-language related contributions (formatting, planning, and non-project communication). All members of all teams contributed, and yet each team had one student with higher participation rates. In addition, students simultaneously pooled their knowledge to

create their texts and used the space in unexpected ways (e.g., simultaneous in-text planning and offers of help).

DISCUSSION

This study explored how students engage in collaborative writing using Google Docs. It builds upon research into how technology has affected the writing process in the past and responds to a need in the literature for more research into the nature of the collaborative writing process. The first research question asked how students engage in the collaborative writing process using a Web-based word processing tool. While more LRCs were made than NLRCs, both types of changes occurred fluidly throughout the writing process. Students did not wait until they completed the content of their writing project, for example, to make formatting changes (NLRCs) in the documents. Instead, they made planning and formatting changes or contributions throughout the writing process. Thus, this Web-based word processing tool can be seen as flexible and allowing for fluidity in the process of collaboration and writing. Within the LRCs attending to form, the most changes were made in spelling, followed by punctuation and then spacing changes. Changes in grammatical errors (such as plurals, pronouns, part of speech, and verb tense) occurred less frequently. It is unclear why students chose to correct seemingly more simple errors in form such as spelling and punctuation (as opposed to more complicated form errors such as verb tense). Changing spelling and spacing would appear to be easier for NNESs than would be changing verb tense or plurals. These findings are similar to those found by Kessler (2009) in his study with students working in collaborative wiki space. In that study, students were able to make the changes to form correctly when asked, but they often chose not to do so in their writing, explaining that they found those errors to be less important than meaning. In this study, students also paid primary attention to meaning in their contributions.

While students made fewer contributions to form, the changes they did make were overall more accurate (79%) than inaccurate (21%). These findings are consistent with Elola and Oskoz (2010), in that students writing collaboratively in a wiki demonstrated improved accuracy. In addition to examining changes in form, students also demonstrated involvement in the writing process in this current study. The current participants' attention to process shows that they valued the write and revise paradigm and were willing to do so within a group context. This is particularly encouraging, since Storch (2005) has noted that students involved in collaborative writing projects may focus on the product more than the process. Also illustrating their commitment to the actual process of collaborative writing was that students were willing to work together as they engaged in collective scaffolding (see Storch, 2005). At times this communication and collaboration resulted in lengthy back-and-forth and simultaneous changes. This simultaneous editing and collective scaffolding allowed students to pool their linguistic knowledge and analyze their language production. The ability to provide and receive timely feedback is important for optimal collaborative writing to occur (Storch, 2005). In addition to attention to process, students also demonstrated in-process planning as they wrote their texts. Their in-text communication sheds light on how they used the space to discuss the organization of the paper, plan logistics, seek help, and share strategies in handling writing concerns. Web-based word-processing tools also allow observations of student behavior, opportunities which are not available without these tools.

The second research question involved students' participation in each group. It was observed that there were three participation levels in all groups: a team member who made approximately half of the team's changes, a second member who made approximately a third of the team's changes, and another member who made from 15-25% of the team's changes. Since social interaction in writing is valuable for support and guidance, it is encouraging that all students participated. It is unclear why participation varied among individual students, but this provides an opportunity for future research. Survey results (see Appendix) and the texts themselves provide some information regarding participation. All team members felt that members contributed equally, and the documents themselves showed no evidence of conflict when

previous versions of the texts were analyzed. Thus, it is unlikely that team conflict contributed to the different online writing participation levels. The academic nature of the collaborative texts themselves may be a possible reason for the differences. Observation and analysis of the documents indicated that some students were more prepared for writing in the academic genre. Other factors contributing to the different levels might be the students' comfort with the Web-based word processing program, their comfort and experience with collaborative writing tasks, roles the teammates took on explicitly or implicitly, or overall comfort and confidence with writing academically in English. It should be noted, though, that the differing rates of participation were not perceived to be problematic to the students. This is significant given Spigelman's (2000) finding that trust and a willingness to share authorship are crucial for collaborative writing to succeed. Another possibility for differing participation rates could be students working together at the same computer. Future research could explore the extent to which this occurs and how it may affect perceptions of ownership.

Thus, this study shows that students focus more on meaning than on form, but that when they do focus on form, they make correct more often than incorrect changes. They also demonstrate attention to process by assisting each other through collective scaffolding. The tool allowed the researchers to observe the students as they collaborated through the fluid process of planning, writing, revising/editing, and formatting. As they aid each other in edits and idea development, they demonstrate the willingness and ability to work together in the writing process. The teams' contributions illustrate the preparation, planning, and recursive revision practices associated with process-based writing and demonstrate how students negotiate the space between simultaneously being a member of a group and an autonomous writer.

Limitations and Pedagogical Implications

This study examined students engaged in collaborative academic writing. Information was gathered in text form in an extant class. These realities may limit access to specific details related to individual student's contributions. For example, a student's location was not recorded nor was any attempt made to monitor student interaction with other individuals or resources (other than observing the production of text) while engaged in the task. Further, this study did not intend to evaluate the quality of the final product. All of these acknowledgements deserve reflection from the reader as well as researchers who will embark on similar studies. Yet, a number of pedagogical implications can be seen.

Building on previous work of how technology has affected the writing process, we see that when students use Web-based tools for collaborative writing, they engage in the writing process in new and unexpected ways. Lam and Pennington (1995) comment on the likelihood that new technologies will give rise to innovative strategies in education, and Storch (2005) notes that a "re-conceptualization of classroom teaching" may be required in order for L2 students to be prepared for collaborative writing (p. 169). It seems clear that as technology evolves, teaching of L2 writing and of student use of these tools will evolve as well. This exploratory study has begun to document that evolution, but the language learning potential of these Web-based word processing tools may only be realized as a result of exploring and experimenting with varied collaborative writing tasks and pedagogical practices. We suggest that future language teaching and learning will be informed by the co-evolution of collaborative writing tools, student use of these tools, and pedagogy as influenced by these tools. Figure 3 illustrates this dynamic relationship.
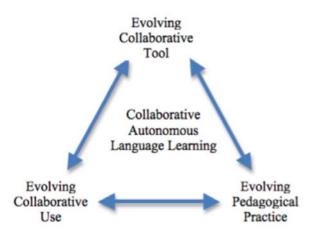
Evolving
Collaborative
Tool

Collaborative
Autonomous
Language Learning

Evolving
Collaborative
Use

Evolving
Pedagogical
Practice

Figure 3. A framework for the co-evolution of collaborative autonomous pedagogy.

This figure illustrates the unfamiliar and evolving nature of Web-based word processing and students' use of this space and shows how the tools communicators use and the way they use them often co-evolve (Thorne, 2003). The pedagogical potential of this type of tool may influence an evolution of pedagogical practices and considerations. While collaborative writing has typically been limited to pair work in the past due to the restrictions of face-to-face or shared document conventions, these evolving tools allow many-to-many and simultaneous collaborative opportunities. As these opportunities arise, it will be increasingly important for students to be able to navigate these spaces, spaces which include new technologies, new pedagogies, and the existing tension involved in being one individual writing a collaborative paper. Helping students develop their autonomous language learning abilities as they collaborate will therefore become vital. This will be possible by providing collaborative writing projects that allow students to practice autonomy in these spaces, have input into expected outcomes, and maintain flexibility in how they use these tools and interact within them. The development of such abilities is inherently reliant upon the nature of collaborative tools that allow for writing practices in which collaboration can occur across many participants, within many different locations, and/or across varied periods of time. Such tools can support emerging pedagogical practices in the writing classroom as well as an increased variety of writing projects and tasks. By promoting the practice of larger group writing projects that capture these new potential benefits of synchronous collaboration, we will better recognize their role within the teaching of second language writers.

The use of tools such as Google Docs also allows teachers to establish practices of monitoring student progress throughout the writing process without the need to formally collect drafts. By monitoring student contributions teachers will gain greater insight into how their individual students and groups use these tools as they continue to evolve. Since all contributors have access to editing the same document at the same time, everyone can participate without having to wait for a collaborator, leading to more engagement in the writing process. Related to synchronicity, there is only one saved version of the document with these tools, meaning that no one team member has exclusive access to the paper at any given time. The ability of all contributors to see all previous revisions also mitigates the individual versus team writing tension. Students know at all times that changes they make will be automatically saved and possibly viewed by teammates, and teammates know that they can see any previous versions of the shared document. Knowing that their writing will always be saved and accessible, students may be more willing to take risks in their idea development in order to work toward the group goal. These features of Web-based word processing tools allow for more transparency and ease of use in the collaborative writing process. In turn, these features address concerns that teams must trust each other with co-ownership in order to succeed in their collaborative writing (Spigelman, 2000). As Web-based technologies continue to

grow in use and in functionality, many opportunities arise for shared learning and language development to occur in L2 collaborative writing projects within these spaces. Writing instructors may want to engage students in discussions regarding how they will handle writing within collaborative projects, such as the degree to which they maybe want to/are able to write sections while sitting physically together, how much they may choose to write individually and then provide comments for each other in the online environment, how they will divide the sections and topics for writing, and so on. These discussions will likely assist students as they navigate collaborative projects with Web-based word processing tools.

CONCLUSION

This study has revealed that highly-proficient non-native English speaking students who were engaged in a collaborative writing project using Web-based word processing tools focused on meaning over form as they created their texts, though grammatical changes made were overall more accurate than inaccurate. Students also successfully collaborated in groups and developed their own process toward writing. Survey information indicated that students appreciated various aspects of the Web-based collaborative writing activity and felt that they worked together successfully and that each member played an important role. They also felt that their contributions were valued and they valued the contributions of their respective group members. Observing student participation through the framework of collaborative autonomous language learning allowed us to gain insight into the collaborative nature of how students interact with others in varied ways. Such practices have only recently become possible in the context of these emerging collaborative technologies.

It is thus important to consider the co-evolution of Web-based word processing and emerging student abilities for using such tools. It is also important to reflect upon the relationship between the evolution of the use of these tools, the tools themselves, and the related pedagogy in order to identify approaches to encouraging flexible pedagogical practices. Such pedagogical reflection would promote guidance toward more extensive preparation to exploit the potential of these emerging technologies and to allow students the flexibility to define to some extent their own use of the environment. The co-evolution of technology, pedagogy, and the nexus of the two create opportunities for wholly new writing environments and experiences. Utilizing emerging collaborative writing technologies without adapting pedagogical writing practices inhibits the potential for this co-evolution. Developing collaborative autonomous language learning abilities within writing projects allows students to prepare for new and unanticipated writing opportunities. While we do not presume to know how these technologies or pedagogies will evolve, it is important to recognize that evolution is underway and that teachers and students can and should be active participants in the process.

APPENDIX. Student survey feedback about their use of Google Documents for their Collaborative Writing Project

1) Frequency of Use of Google Documents for Collaborative Writing Project

How Often	Number of Students
5/Day	1
2/Day	1
1/Day	24
1-3/Week	7
No Answer	5

2) Type of use in Google Documents for Collaborative Writing Project

Type of Use	Yes	No	No Answer
Document Creation	22	9	7
Document Revision	34	1	3
Presentation Creation	4	26	8
Sharing	37	1	0
View/Review History	16	18	4

3) Positive and Negative aspects of Google Documents

Positive (number of comments)	Negative (number of comments)
Shareable (9)	Tools too basic (9)
Time saving/Efficient (2)	Too cumbersome (2)
Useful (4)	Too many options (1)
Easy to use (2)	Revision feature complicated (1)
Synchronous (1)	Presentation feature inferior to PPT (2)
Provides revision history (1 comment)	

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