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Computer-based multimodal composing activities, self-revision, and L2 acquisition through writing

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Abstract

This study investigated how 22 advanced-low proficiency ESL students used computer-based multimodal composing activities (CBMCAs) to facilitate self-revision and learn English through academic writing in the USA. The CBMCAs involved a combination of writing, listening, visual analysis, and speaking activities. The research was framed within an integrated theoretical framework of multimodality, the noticing hypothesis, and the multi-dimensional model of revision. Data include surveys, students' revision history, online multimodal posters, reflections, screen recordings of listening activities, stimulated recall interviews, final written drafts, and scores on those drafts. Data collection and analysis followed a descriptive case study design with embedded quantitative data. Findings indicate that CBMCAs helped students discover specific rhetorical and linguistic elements that they used to revise their written drafts. In addition, students reported that the activities helped them develop language and voice to convey ideas that they were struggling to express using the written mode alone. Contrary to findings in most previous research, the students did more content-level than surface-level revisions. Also, there was a significant correlation between total frequency of revision and text quality. The practical and theoretical implications of these findings for L2 writing pedagogy and research are discussed.

Keywords: *Revision, L2 Writing, Multimodality, Online, L2 Acquisition, L2 Composition*

Language(s) Learned in this Study: *English*

Introduction

Research in second language acquisition (SLA) and computer assisted language learning (CALL) shows that successful language learning requires a co-constructed process of communication skills (Hafner, Chik, & Jones, 2015; Jeon-Ellis, Debski, & Wigglesworth, 2005) and that "languages are best learned by a combination of talking, hearing, reading, and writing" (Magnan, 2007, p. 153). Even though some studies have shed light on the role of individual skills in L2 development, not much research exists on how the combination of these skills in language learning activities facilitates L2 acquisition (Barkaoui, 2007; Nishino & Atkinson, 2015). Some L2 writing studies have called for more research on how integration of other skills might facilitate language learning through writing (Leki, Cumming, & Silva, 2008; Warschauer, 2000, Wijaya, 2006).

Most previous research on multimodal composition in L2 has turned to focus on how to integrate different modes in projects, such as digital storytelling and infographics. No study known to the author at the time of writing this paper focuses on how transfer among different modes aids L2 acquisition through writing. This study complements existing research because of its special focus on how transfer among oral, written, and visual modes might help L2 students notice linguistic and rhetorical features that need revision in their compositions. The study sought to answer one question: To what extent do revisions prompted by computer-based multimodal composing activities (CBMCAs) facilitate advanced-low ESL writer's ability to notice gaps in their written drafts and improve the quality of their writings? Findings from the study

contribute to L2 research and pedagogy by providing empirical evidence on the potential of and the challenges associated with using CBMCAs as procedural support to help ESL writers learn language through writing. An integrated theoretical framework, combining perspectives from multimodality (Kress & van Leeuwen, 2001), the noticing hypothesis (Schmidt, 1990), and the multi-dimensional model of revision (Stevenson, Schoonen, & Glopper, 2006), informed the design of the study.

Literature Review

Multimodality: Language as a Semiotic Mode

As a theory, multimodality emphasizes the interconnection among representation, meaning making, and communication as distinct but interrelated processes (Kress, 2010). In second language education, multimodality was adopted by the New London Group (1995) to describe the process of integrating different semiotic resources such as written or verbal text, images, and sounds to make and represent meaning. In this study, *multimodality* refers to the "use of several semiotic modes in the design of a semiotic product or event," and *modes* are defined as "ways of representing information or the semiotic channels we use to compose a text" (Kress & van Leeuwen, 2001, pp. 20–22).

Language is one of several modes that people bring together in a multimodal ensemble (Finnegan, 2002). Advocates of multimodal approaches to teaching and learning argue that in meaning making, representation, and communication, language and other non-linguistic modes are equally important. This view of equating non-linguistic modes to language is perhaps the most strongly contested assumption of multimodality. Some have interpreted the place of language in multimodality "as an attempt to side-line language" (Jewitt, 2009, p. 2). However, far from sidelining language, multimodality seeks to highlight how language and other modes interact and sustain each other in communication (Shipka, 2005). Each semiotic mode has a distinct affordance, and the integration of different modes provides an orchestration of meaning in a given context of communication (Jewitt, 2009).

Multimodal Composing as Procedural Support

This study adopts two perspectives from multimodality: *writing as design* (Hyland, 2009; Kern, 2000), and *intersemiotic complementarity*, which is the collaboration between different semiotic modes "to produce a coherent multimodal text" (Royce, 2002, p. 193). In multimodal composing, a writer is a designer (Kern, 2000). Writing goes beyond the written text. It is an art in which "writers design and redesign all the modes of representation they draw upon in the production of multimodal texts in order to convey their intended meanings" (Shin & Cimasko, 2008, p. 377). It is "assembling text and images in new visual designs, and writers often need to understand the specific ways of configuring the world which different modes offer" (Hyland, 2009, p. 59).

A number of studies have reported that integrating non-linguistic modes may help reinforce, clarify, compensate for, or reveal contradictions in students' writing (Hafner, 2013; McKee, 2006; Nelson, 2006; Salbego, Heberle, & Soares da Silva Balen, 2015; Yang, 2012). Shin and Cimasko (2008) observe that "multimodal approaches to composition provide writers who are having difficulty in using language, including those writers for whom English is a second language (ESL), with powerful tools for sharing knowledge and for self-expression" (p. 377). Lee (1994) found that the use of pictures helped students to recall past experiences, reduce anxiety, activate vocabulary they had learned, generate more ideas for their papers, and revise written drafts in ways that led to an overall improvement in writing proficiency. The current study sheds some light on the potential of multimodal activities to help students notice linguistic and rhetorical issues in their writing and improve their written communication.

Noticing in L2 Writing

In addition to multimodality, the study used perspectives from the noticing hypothesis that learners' awareness of a mismatch between their input and output is necessary for acquisition of a second language (Schmidt, 1990). The use of noticing hypothesis in this study rests on the assumption that taking steps to

revise one's output to make it more intelligible can occur not only in speaking but also in writing (Cresswell, 2000; Hanaoka, 2007; Leow, 2000; Swain & Lapkin, 1995; Williams, 2012). Previous studies mostly used this theory to investigate how learners notice problems with lexical and grammatical forms in their drafts (Cumming, 1990; Cumming & So 1996; Izumi, 2002). However, the application of the noticing hypothesis in this study is novel. It goes beyond focusing on lexical and grammatical forms to include how students notice metalinguistic and rhetorical features at the macro level of their writing. Specifically, this theory helped to understand how CBMCAs triggered internal revision and enabled students to notice issues with language, content, and organization of their academic papers.

Multi-Dimensional Model of Revision

Another theoretical perspective adopted in this study is the multi-dimensional model of revision (Stevenson et al., 2006), which focuses on revision in a computer-based composition and combines ideas from the traditional, recursive, and cognitive models of revision. Unlike the linear model which sees revision as "a separate stage at the end of the process—a stage that comes after the completion of a first or second draft and one that is temporally distinct from the prewriting and writing stages of the process" (Sommers, 1980, p. 378), the multi-dimensional model explains revision in terms of location and orientation. Regarding location, revision is seen as a recursive activity that could be embedded at any stage of the composing process: before, during, and after transcription. In orientation, revision involves internal and external changes that a writer makes. Internal revision might include all the mental changes that take place before a writer begins a draft (pre-textual revision). For instance, a writer might think about four different topics before deciding on one that gets transcribed into a written text. External revision is the observable changes at the point of inscription. In this model, revision is both a mental and physically observable activity. Based on this understanding, revision is defined in this study as the ongoing mental and physical changes to a text, changes that may be error-triggered or non-error-triggered. This way of understanding revision allows for collecting data on both the mental processes (noticing) and the textual changes that occur as students compose their essays.

Methodology

Descriptive Case Study

This descriptive case study with embedded quantitative data was conducted in an undergraduate ESL writing (16 -week, 3-credit) classroom at a North-American university. There were 22 students in the class. This class was different from the regular English classes at the university because of its special focus on multimodal composition. All assignments in the class required integration of written and visual modes (still images), as well as oral presentations and listening activities meant to facilitate students' revision. The class met for 1 hr 30 min, twice per week. In addition to the regular class meeting times and 2-hour office hours, there were four individual student–teacher conferences spread over the 16 weeks.

Data Collection

Data came from surveys and students' revision history (*content-level revisions*, which involved revisions that were meaning-changing, e.g., *She has two cats* became *She has three cats*; and *surface-level revisions*, which involved revisions that were meaning-preserving, e.g., *The man in a red shirt is my father* became *My father is the man who is wearing a red shirt*). Other data came from online posters, reflections, listening activities, stimulated recall interviews, final written drafts, and scores on those drafts. Although both sets of data (qualitative and quantitative) from all participants were used to determine frequency and type of revision (surface or content level), only the data from six focal students were used for in-depth qualitative analysis. Three main types of software were used for the CBMCA: Google Docs, Glogster, and NaturalReader. As seen in Figure 1, Glogster is an online multi-media site for educators that allows users to create and share interactive posters by integrating different modes—such as written text, images, audio, video, and graphics.

NaturalReader is a text-to-speech (TTS) program that allows "playback of printed text as spoken words" (Atkinson & Greches, 2003, p. 178). As the text is being spoken, users may control the speed of the voice, pause the playback, or stop the speech and correct any errors they detect in the written text. Google Docs is an online word processor that allows users to create, store, and share documents. Google Docs can be used for online collaboration in real time or asynchronously. It also records a revision history of each document. These revision histories provided useful data for understanding how students' drafts developed throughout the process of composition.

Participants

22 ESL learners took part in the study. They included 14 Chinese, 3 Malaysian, 1 Sri Lankan, 2 South Korean, and 1 Nepalese students. 16 of the participants had taken the TOEFL iBT (Test of English as a Foreign Language), and their scores ranged between 72 and 95. Six had taken the IELTS (International English Language Testing System) exam and reported scoring within a range of 6.0–6.5. Based on the interpretation of their TOEFL, IELTS, and EPT (the university's English placement test) scores, the university considered these students advanced-low writers.

Participants were divided into three groups based on how they used the poster activity in the composing process during the semester. Group A used it for both pre-writing and point-of-writing revisions. Group B used it mainly for point-of-writing revision, and Group C used it mainly as a pre-writing activity. The division of the class into groups is in line with the embedded case study approach, which "occurs when, within a single case, attention is also given to a subunit or subunits" (Yin, 2009, p. 50). Six main focal students were selected for in-depth analysis—two from each group. They were given the following pseudonyms: Shirley and Lenard represented Group A; Felicity and Tonia, Group B; and Ryan and Anderson, Group C. These students were selected because their use of the poster activity was representative of other participants in their respective group.

Procedure

The study lasted for 16 weeks. After signing the consent form, students completed the pre-survey. This was analyzed to make decisions about learner training—a crucial step for the success of any CALL activity (Hubbard, 2004). Three 50-minute learner trainings were provided in the computer lab. The first session focused on introducing students to Google Docs. The second session focused on helping students create online posters using Glogster; and the third session trained students on how to use NaturalReader. There was also explicit training on integration of written and visual texts in acdemic writing. Students used Microsoft Word to practice how to provide captions for visuals. They also learned the principle of ensuring that visuals are appropriate for their target audience, placed where readers can easily locate them, and are referenced in the written text.

Figure 1. Glogster

Data Collection

Data collection began in the second week as students started the first expository essay, Assignment 1, which required students to write about their role models and the impact that the role models had on their lives. This was considered baseline data and students used only the written mode to complete this assignment in Google Docs. They used CBMCAs for Assignments 2, 3, and 4. In Assignemnt 2, students explored an issue of their choice and wrote a 650-word essay. In Assignment 3, they chose an artwork or a place on campus, analyzed it, and wrote a 700-word essay focusing on the meaning their particular artwork has for people on campus. Assignment 4 asked students to choose one controversial issue that affected the university community or the larger society and compose a 700-word argumentative essay on the issue.

Students were asked to follow six steps in completing CBMCAs. First, they composed a written draft using Google Docs. Second, they created an online digital poster using Glogster and integrated as many modes as they wanted. Third, they wrote a reflection on how composing the poster helped them notice gaps in their written drafts and generate ideas to fill those gaps. Fourth, students continued the revision of their written texts in Google Docs. Fifth, they performed a listening activity in which they used NaturalReader to revise for style and grammar. They copied and pasted their written text into the software and listened to their texts read aloud by the program. As they noticed an error, they either paused and corrected it or made notes about the need for revision. Sixth, they integrated visuals (still images) into their written texts in class and wrote responses to the following questions: Why did I choose this visual? What is the main message in this visual? What information does the visual give that is not already in the written draft? How does the message in the visual help me build on the ideas in the written draft? Table 1 explains the steps involved in CBMCA.

As part of the multimodal composing activity, students were guided to reflect on how CBMCAs helped them notice gaps in their work and make content- and surface-level revisions. The reflection focused on helping students identify linguistic and rhetorical choices they made in creating the online posters and how those choices helped them notice features that needed attention in their written texts. As shown in Appendix A, the guide contained 16 questions that were divided into substance, language and style, or organization. The questions in the substance section were meant to help participants think about their theses, details, audiences, purposes, and messages contained in the other semiotic modes (visual, recorded voice, and video) that were not already expressed in the written text. Students also reflected on how the message and ideas in their posters helped improve their written draft. The last five questions focused on organization of ideas and materials in the poster, as well as how the arrangement helped organize ideas in the essay. Providing this kind of guidance for students during their reflection was necessary, because, left unguided, students who lack effective metacognitive skills could focus on too many issues in their reflection, which could make data analysis very difficult (Gass & Mackey, 2007).

In addition to guiding students to reflect on the poster activity, the researcher met with each participant on four occasions for stimulated recall. Each meeting lasted for approximately 40 mins. In all, there were 3,520 mins (59 hours) of interviews with the participants. During the stimulated recall, students were shown their posters as well as the drafts they wrote immediately after making the poster. They were then asked to comment on how they developed or even changed their ideas on the topic as they composed the poster. Students were also shown their final multimodal text and were asked to comment on decisions they made while integrating the visuals as well as how that facilitated their revision.

Since the researcher was also the instructor of the class, some measures were taken to ensure credibility and reliability of the findings. These included making students aware that participation in the research was optional and had no impact on their grades, asking other trained raters to grade students' papers based on a rubric, calculating inter-rater reliability, coding data with a second coder, and calculating inter-coder reliability.

Table 1. *Matrix for CBMCA*

Steps or Activities		Rationale	Semiotic Modes	Technology
Step 1:	Compose alphabetic text	Develop a draft	Written/alphabetic	Google drive
Step 2:	Create interactive poster	Focus on content-level revision	Written, oral, and visual (still and moving images)	Glogster
Step 3:	Write reflection	Focus on noticing gaps and generating ideas	Written /alphabetic	Google drive
Step 4:	Continue revision of existing draft	Improve ideas in existing draft	Written/alphabetic	Google drive
Step 5:	Listen to essay using TTS	Focus on noticing grammar errors and improving organization	Oral and written	NaturalReader
Step 6:	Integrate visuals into final draft	Produce a multimodal text	Written and visual (still images)	Google drive and Microsoft Word.

Data Analysis

Data collection and analysis occurred simultaneously. This allowed for member checking and gave participants the "opportunity to discuss and clarify the interpretation and contribute new or additional perspectives" (Baxter & Jack, 2008, p. 556) on how they used CBMCAs to facilitate revision. Data from students' surveys, written drafts, online posters, screen recordings of listening activities, reflections, and stimulated recall interviews were downloaded and transcribed. Five codes were adapted from the multi-dimensional model of revision (Stevenson et al., 2006). Textual changes in Google Docs were considered the observable behavior of noticing (Hegelheimer & Chapelle, 2000) and were coded either as surface- or content-level revisions, additions, deletions, substitutions, error-triggered revisions, and non-error-triggered revisions. Inferences about noticing in the listening activity were based on observable changes and the notes students made to themselves that were captured in screen recordings.

In addition to the multi-dimensional model, an open coding system (Miles & Huberman, 1994) was used. Tags were used to assign units of meaning to inferences made during the study. After initial parsing of the data, 35 codes were developed based on the open-coding system. The research design, theoretical framework, research questions, and codes were explained to a second coder, who held a master's degree in Teaching English as a Second Language and taught ESL writing. The researcher and the second coder used data from two (of the six) focal students to practice the codes. After the two coders agreed on the total number of codes and their definitions, the codes from the open coding system were reduced to 21 and were added to five codes adopted from the multi-dimensional model of revision. In all, 26 codes were developed (see Appendix B). The second coder and the researchers coded 25% of the data from all students. The inter-coder agreement calculated using simple percentages, was 90%.

Inferences about the impact of CBMCAs on the revision process were made based on a comparison of the means (*t*-test) of students' total revisions in each assignment, as well as the means of particular types of revision students made. Three ESL teachers graded the students' final papers, which were multimodal texts that combined written texts and still images, using a rubric based on intersemiotic complementarity (Royce, 2007). This approach to assessing multimodal texts focuses on how the integration of different modes presents new meanings. It uses the concept of sense relations (Halliday, 1985) to assess multimodal texts at two levels proposed by The New London Group and other researchers: analyzing each mode separately and then analyzing how they are synthesized to produce a unified multimodal text (Kress & van Leeuwen, 2006). The rubrics also assessed the substance, organization, style, and delivery of students' final texts (see Appendix C). To collect validity evidence for the rubric, an inter-rater reliability was calculated among the

three raters. They graded 12 essays from the focal students (Assignment 2, 3, and 4) using the revised rubric. The inter-rater reliability (Kendall's tau-c) among the three raters was 0.972. Finally, the correlation (Pearson's) between the final text scores and the frequency of revision was calculated in order to determine the extent to which student's revisions related to text quality.

Results and Discussion

The research sought to understand the extent to which revisions prompted by CBMCAs might facilitate advanced-low ESL writer's ability to notice gaps in their written drafts and improve the quality of their writings. In general, the findings indicate that CBMCAs facilitated internal revision and helped students discover specific information, linguistic elements, and organizational structure that they used to revise their drafts. In addition, the activities helped students notice problems with rhetorical and linguistic features of their drafts, revise content and organization of ideas, and develop language and voice to convey ideas that they were struggling to express using the written mode alone. Further, there was a significant correlation between total frequency of revision and text quality.

Participants reported that integrating multiple modes gave them the opportunity to practice their English and produce language in a way that they found easier than just expressing themselves through writing. Anderson noted the following during the stimulated recall: "I liked the thing of saying what I want to write as part of the poster because writing it down makes me slow because when I write I check grammar and think which is hard."[1] The idea that recording their thoughts in the poster helped them express themselves more fluently and generate ideas for their papers was mentioned by 60% of the students. In general, responses from the exit survey showed 91% of students agreed that making the poster was helpful for their writing, with 9% indicating disagreement. 82% said the poster activity helped them notice things that needed revision in their writing while 18% indicated that it did not facilitate their noticing. In addition, 90% of students said they would continue to explore the poster activity on their own to revise the content and organization of their papers, while 10% said they would not explore the poster activity on their own. Table 2 presents students' perception of the poster activity.

Table 2. *Students' Perception of the Poster Activity*

Statement	Responses (N = 22)			
	1 Strongly Agree	2 Agree	3 Disagree	4 Strongly Disagree
Q5. Making a poster as part of the writing process was helpful to me.	7 (32%)	13 (59%)	2 (9%)	0 (0%)
Q6. The poster activity helped me to notice some things in my paper that needed to be done differently.	5 (23%)	13 (59%)	4 (18%)	0 (0%)
Q7. Depending on what type of paper I am writing, I may continue to explore how making a poster might help me develop the content and organization of my papers.	9 (41%)	11 (50%)	1 (5%)	1 (5%)

Developing Language and Organizational Structure

Intersemiotic analysis of the poster and the written drafts of students in groups A and B shows that the same ideas were repeated verbatim or expressed in similar ways in the two documents. For instance, Shirley followed the organizational structure of the poster in developing the ideas in the written draft. As seen in Table 3, she discussed the failing economy, factors that caused the problem, impact of the crisis on people, and called for immediate action to be taken to address the issues. Some of the causes for the failing economy

that she discussed as well as the solutions she proposed in her final draft were borrowed from the video in her poster.

Table 3. *Intersemiotic Analysis of Shirley's Poster and Written Draft*

Visual Elements in Poster	Description	Linguistic Representation of Ideational Meaning in Written Draft	Intersemiotic Complementarity
	The US economy is failing	The U.S. economic issue has been existed for many years but get more ailing (Excerpt from Shirley's introduction).	**Synonymy**: • Fail • No more ignoring or biggest concern
	The problem has caused unemployment, which is destroying the lives of the citizens and people around the world.	After that, high unemployment rate becomes the biggest concern of American citizens. (Excerpt from her third paragraph).	**Linguistic Repetition**: • Unemployment • The US economy • Ignoring
	This alarming situation can no longer be ignored.	The economic issue of United States has become an economic concern in worldwide because the important role that dollar plays in the world economy. We have to do something about it instead of ignoring it like we did before (Excerpt from her conclusion).	**Repetition of Ideas**: • The economy is failing and needs attention • Everybody is affected • We have to do something about it

Reflections from the six focal students (see Table 4) indicate that the poster activity helped them discover specific information, words, phrases, and organizational structure that they used to revise their written text. Students in groups A and B, who used the poster for point-of-writing revisions, reported that the activity helped them notice and revise. However, those in group C, who used it solely as a pre-writing activity, found the poster activity less helpful.

Table 4. Students Guided Reflections for the First CBMCA

Questions	Participant Responses					
	Group A		Group B		Group C	
	Shirley	Lenard	Tonia	Felicity	Anderson	Ryan
Q7. What information do the images/videos give that is not already in your written draft?	The details about how to fix the ailing economy	The table shows the number of students who come to America	I haven't written any examples about the medicine advertisement.	Serial killers' background	The audience can see the "real" problems that exist in today world when education is not equally distributed	The different way of living between poor and rich
Q8. Comparing your written draft with your poster, what new information do you think your poster brings to your audience?	A clear and straight sense that the economy is falling and sick.	The reason why more and more Chinese students come to America	It points out food, beauty product and medicine advertisement are sometimes untrustworthy	More details story about some of the serial killers.	Audience will start to realize what is actually means by civilization	I think all things in my poster is contain in my draft
Q9. How will the ideas in the poster help you build on the ideas in your written draft?	It helps me build a well-organized paper with my four sub-topics	It makes the main idea of my passage more clear	I can write advertisement for food for one paragraph	The organization of the ideas as well as the additional points on the video.	It serve as a brainstorm for me to come up with more ideas	Actually, I don't think the poster can help me to build the ideas
Q10. What words on the poster convey the main message of the poster?	How to fix the economy; No ignoring; unemployment; Tax rate	Better, English Education, Less Expense, Convenience Transportation	Advertisements make products seem better than they really are	Serial killers on the loose. Why?	Education for better civilization	The top sentence
Q16. How might the organization of ideas in your poster help you organize your ideas in the written draft?	It will help my written draft with a better structure.	My written draft followed the bulleted point in the poster	First, write the thesis. Then, explain it. And divide the advertisement into three aspects	It helps me arrange my points better and it's easier for me to get ideas with the help of the images, videos	It gives me better guideline on how to arrange the ideas	Helpless

Furthermore, Shirley's comment from the interview shows that making the poster gave her an opportunity to do a two-way revision:

> Umm, for me the poster and the paper itself um they are like revising each other. Sometimes I come up with some good ideas for the poster and I add them to the paper and sometimes I think of something I can write in the paper to make the statement better and after I wrote something I will add some picture to the poster too. So it's a two-way revision.

Lenard's perception about the poster activity was similar to that of Shirley and other students in Group A and Group B. He reported that the poster activity helped him organize his essays more effectively: "My written draft followed the bullet point in the poster….I will write each aspect in each paragraph. And the main message of the poster will be the thesis of my essay." Felicity also stated: "It helps me arrange my points better and it's easier for me to get ideas with the help of the images, videos and points that are broken down." Intersemiotic analysis of her final draft and the poster (see Table 5) showed that the two documents had the same ideational meaning.

Table 5. *Intersemiotic Analysis of Felicity's Poster and Written Draft*

Visual Elements in Poster	Description	Linguistic Representation of Ideational Meaning in Written Draft	Intersemiotic Complementarity
	Images of serial killers	People should be aware of the surrounding wherever they are.	**Linguistic Repetition**: • Victim • Serial killers • Tragedy
	Symbol of death	This is a serious matter.	**Synonymy**: • Victims can be anyone/anybody can be victim • Serious/dangerous
	People of all ages shown possible victims	No one should take this lightly. Anybody can be victim of serial killers.	**Repetition of Ideas**: • Everybody can be a victim so we all need to be alert and help fight this social evil.
	A tragic murder video	One mistake can cost them their life. (Excerpt from Felicity's conclusion; paper 2)	Serial killing has become a serious problem for the society.

During the interviews, Felicity also indicated that the poster helped her overcome writer's block when she used it as a pre-inscription activity:

> Researcher: Um, one reason for making you do the poster, listen, and add visuals to your essay is to help you see some things in your paper that need improvement. Do you think that is happening?

> Felicity: Um sometimes I don't have any ideas to write and when I design the poster and I find the pictures and visuals and everything then I started getting the ideas of what I am going to write and

I yeah, I think um visual is one element that helps a lot with my writing.

Contrary to the experience of students in Group A and Group B, those in Group C—like Ryan and Anderson—did not see the poster activity helping them to make revisions. In his reflection, Ryan wrote the following: "Actually, I don't think the poster can help me to build the ideas". He also attributed his lack of interest in the poster activity to the fact that he is not a visual learner and that his challenges are with grammar and not rhetorical features:

Researcher: Hello Ryan, tell me something about the poster

Ryan: It's fine, it's just wastes my time…because I prefer to write a draft by words, not by a poster, poster, so I think it's a waste of my time. Yeah, I don't think it's very helpful. Maybe I'm not a good visual person. I have a lot of problems about the grammar and so I focus just that.

In general, students seemed to have benefited from the poster activity in revising their papers. However, other contextual factors including students' learning styles seemed to impact their perception and use of this activity for revision.

Listening Activity, Noticing, and Revision

As in the poster activity, findings from this study show that the listening activity helped students notice problems with rhetorical and linguistic features of their academic texts. Students also reported that it helped them look at their essays from the readers' perspective and to "see," "hear," and "feel" what needed revision. The exit-survey asked all 22 students to state their level of agreement or disagreement with the statement *Listening to my paper being read aloud helped me to notice some things in my paper that needed revision*. 86% of students agreed that the listening activity facilitated their noticing while 14% said the activity was not helpful for noticing.

Further analysis of the screen recordings and interviews with the six focal students indicated that all of them, except Ryan, found the listening activity useful for noticing. Shirley indicated, during the interview that the activity helped her identify what "sounded weird" in her writing: "I like it very much, using it at times I can feel the essay, the ideas, the structure and grammar and I think it's useful because it can tell you the essay is weird or does not sound correct". Tonia also indicated that listening to her essay helped her see things that needed improvement: "I used NaturalReader to listen to my essay. And I can see it is abrupt in some places or there is no main point in the passage. Then I know how to revise it". The picture narrative of Tonia's listening activity, as seen in Table 6, affirms her comments.

Anderson also indicated that unlike the poster activity, he found the listening activity helpful for revision and learning English. Specifically, he identified the organization, expression, and sentence structure of his paper as elements that needed improvement. The way he wrote the note, as seen in the picture story in Table 7, also indicates that listening to his essay helped him put himself in place of his audience and perceive their needs more effectively: "readers cannot get what I am trying to express."

The following comment sums up Anderson's general perception of the activity by the end of the semester:

In my personal opinion, one of the problems for the international students to write the essay is to make sure the essay is suitable as how the native speaker writes so I think the NaturalReader, it gives the solution to the problem because we can listen how the native speaker speaks our paragraph it sounds like the native speaker is writing it.
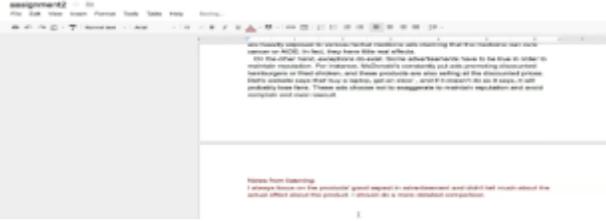
Table 6. *Tonia's Listening Activity and Noticing*

Tonia's Listening Activity	Description	Inferences
	Tonia uploads her essay and listens to it using NaturalReader	She performed the listening activity
	She makes a note on the need to add more details about the effects of advertisements	Listening facilitated her noticing
	Tonia copies and pastes her note in her draft in Google Docs.	Tonia used what she noticed to revise her paper

Table 7. *Anderson's Listening Activity and Noticing*

Anderson's Listening Activity	Description	Inferences
	Anderson uploads his draft and listens using NaturalReader	He actually used listening as a revisionary activity
	Anderson makes a note to himself about the need to improve the organization, the expression, and the sentence structure.	The activity facilitated his Noticing

In general, the activity provided an opportunity for students to notice some grammar errors and other linguistic and rhetorical problems. However, the free version of NaturalReader was less helpful for noticing grammar errors, especially in the case of students with low proficiency levels in grammar. There were many grammar errors in students' papers that they could not notice.

This finding resonates with Garrison' (2009) observation that training students to listen to their writing might have positive impact on revision. Not only did most students find the listening activity useful for noticing issues, but they also considered it one of the most effective ways of knowing how an essay might "sound" from a reader's perspective. Furthermore, students reported finding this activity less stressful and more fun than reading the essays by themselves. Students noted that they performed the listening activity when they got tired or bored with writing. In all, the findings confirmed those of previous research that integrating listening activity into the writing process has the potential to increase students' motivation to write (DiEdwardo, 2005; Garrison, 2009; Wijaya, 2006). The findings also underline the need to introduce

learners to tools that might facilitate noticing of rhetorical and linguistic problems, such as automated writing assessment software that draws students' attention to grammar problems (Li & Hegelheimer, 2013).

Integration of Visuals in Written Text and Noticing

Analysis of the exit-survey and interviews provided insights for making inferences about students' views on integrating written and visual texts as well as how that facilitated their noticing and revision. All 22 students stated that adding visuals to their written text made them revise their content and organization. Also, 95 % said they would continue to explore how the integration of visuals and written texts might help them communicate with their readers. Even though Ryan had indicated that he was not a visual learner, he commented during the final interview that integrating the visuals into his written draft was his favorite activity. He also stated that the visuals helped him discover language and voice that he did not have as he composed his drafts using only the alphabetic text:

> I think if the reader cannot get something that I want to say from my essay, I find some picture for the reader. Some point is difficult to just write down things and there is more to put a picture there into the essay, so I choose that picture. I read it and think if I maybe I can't understand what I mean, so I use the picture.

Ryan's experience affirms the observation that integrating visuals can help students' access meaning at different levels (Salbego et al., 2015).

One possible reason for the apparent contradiction in Ryan's attitude towards the visual activities could be the amount of work that the two visual activities required. Creating the poster demanded more work and creativity than finding images to insert into the already composed texts.

In general, students' interviews affirm findings in previous research that L2 writers find it difficult to express emotions effectively in the target language because "different languages have distinct emotion vocabularies and ways of expressing emotions" (Pavlenko & Driagina, 2007, p. 91). Students' comments that CBMCAs help them hear, feel, and see their essays from a readers' perspectives points to the potential of the integration of modes to help students develop not only rhetorical and linguistic competence, but also strategic competence in the target language. This affirms what has been observed in previous studies that using different modes might enhance the development of L2 learner's competence (Leki et al., 2008; Lemke, 2009).

Students' interviews and survey responses further point to the strength in approaching L2 writing as a design process (Hyland, 2009; Kern, 2000). Some students revealed that, in certain assignments, they did their posters before they began a written draft. They developed some understanding of L2 composition as an "ensemble" in which an author does not always have to start with a written text. Rather, they can begin their composition in any mode and integrate other modes in the process to develop a piece of writing as a communicative event. Such an approach for L2 composition challenges our traditional view on what students' first drafts should look like. It suggests a rethinking of what instructors require as a first draft. For instance, students can record their thoughts and present an audio file as their first draft instead of producing a written draft.

CBMCA, Revision, and Text Quality

Assignment 1 was used as baseline data so students did not use any CBMCAs. They did use CBMCAs in Assignments 2, 3, and 4. However, Assignment 2 was not used for data analysis because it was learner training for students to get familiar with CBMCAs. In general, the findings show that students did more revisions when they used CBMCAs. The means and standard deviations for students' total revisions were as follows: Assignment 1 ($M = 82.4$, $SD = 48.3$), Assignment 3 ($M = 157.3$, SD = 41. 8), and Assignment 4 ($M = 185.9$, $SD = 36.5$). The results of a paired sample t-test analysis shows that there was a significant difference in the total number of revisions that students made between Assignment 1 and Assignment 3 ($t = -4.265$, $p < .001$) as well as between Assignment 1 and Assignment 4 ($t = -6.207$, $p < .000$). In order to estimate the magnitude of the differences in the various revision histories, the effect size was calculated

using correlation coefficient (*r*). The correlation between Assignments 1 and 3 was -0.64 and that between Assignment 1 and 4 was -0.77. The descriptive statistics of the revision history (see Table 8) shows that, contrary to what has been reported in previous studies (Silva, 1993; Suzuki, 2008), students in this study made more content-level revisions than surface-level revisions.

Table 8. *Descriptive Statistics of Students' Revision History*

	Type of Revision								
	Surface-level		Content-level		Error-triggered		Non-error-triggered		
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*N*
Assignment 1	29.5	31.6	61.6	37.1	13.2	15.4	78.1	43.4	13
Assignment 2	33.7	19.6	131	46.2	11.4	14.9	151	44.3	13
Assignment 3	41.5	16.9	153	31.2	8.4	8.3	192	41.3	13

The disparity between the current findings and those of previous studies could be attributed to differences in the way revision was captured in this study and how previous studies analyzed revision. Unlike most previous studies (Garrison, 2009; Gaskill, 1987; Raimes, 2001), this research saw revision not as the growth from one draft to another, but as the record of every change that the essay went through—a developmental history from the beginning of the first draft to the point of submission for grading. In addition, few studies that have analyzed the history of students' revision, such as Chambers (2011) and Hall (1990), have focused on timed essays (usually 90 mins). Unlike such timed essays, papers in this research were take-home assignments. Students had four weeks to complete one essay; and that might have helped them pay more attention to content-level revisions.

In addition to students making more content-level revisions, the findings show two different results regarding total frequency of revision and text quality. The Pearson correlation coefficient for students' revision and scores in Assignment 3 ($r = 0.122$) showed no significant correlation between total frequency of revision and text quality. However, there was a significant correlation ($r = 0.012$) in Assignment 4. The interviews after Assignment 3 shows that most students used the poster activity for pre-writing activities in order to generate ideas for the artwork they were writing about. Most of them noted that they revised their ideas as they were putting the poster together so they did not have to change much of the content when they began writing. This could have influenced the amount of revisions they did at the point-of-writing. This coincides with previous contradictory findings on the relationship between frequency of revision and overall text quality in L2 revision (Reynolds & Bonk, 1996; Stevenson et al., 2006; Yagelski; 1995) and confirms Sengupta's (2000) observation that the relation between revision and text quality is problematic.

Conclusion

This research was designed to investigate how CBMCAs might facilitate L2 writers' noticing and self-revision as they composed academic papers and learned language through writing. The findings provide empirical evidence on how CBMCAs might help L2 writers notice linguistic and rhetorical elements in their writing and revise for effective communication. Integration of different modes helped students make more content-level related revisions and focus on personal language development as they wrote academic papers. The use of CBMCAs also had a positive impact on the overall quality of text that students produced. In addition, the use of an integrated framework, which combines multimodality, noticing, and the multi-dimensional model of revision, provides precedence for the field of L2 research regarding how these three theories might work together in helping resolve the challenges L2 writers have with self-revision. This study also contributes to these theories by showing how the noticing hypothesis can be applied not only to spoken language and syntactic aspects of language, but also to the meta-linguistic and macro-level elements of writing such as organization of ideas. Other pedagogical and theoretical implications of the findings are

discussed below.

Pedagogical Implications

Findings in this study highlight the potential of non-linguistic modes to enhance students' ability to express intended meanings beyond word-based materials (Nelson, 2006) and to provide access to information that may not be easily available through the written mode (MacKee, 2006). Embracing multimodal composition in L2 classroom may help students learn the target language as they compose academic papers. However, using other modes to complement the written mode in meaning making requires careful and strategic integration. CBMCAs are effective when activities are integrated into a syllabus that is based on a multimodal approach to composition rather than when they are added on to a traditional writing syllabus. Such a syllabus calls students' attention to writing as a communicative event and the writer as a designer, contains objectives for the different modes, requires students to produce multimodal texts, and emphasizes linguistic and rhetorical features of academic writing. Developing a multimodal syllabus for L2 writing requires a pedagogical shift from a predominant focus on *learning-to-write* (an approach that sees the writing classroom as a place to help students express already-acquired language through writing) to *writing-to-learn* (Hanaoka & Izumi, 2012; Harklau, 2002; Manchón, 2011).

Theoretical Implications

Theoretically, research on revision has been greatly influenced by the process approach to writing and its emphasis on multiple drafts. Most previous studies saw multiple drafts as the marker of revision and focused on comparing multiple drafts. Conclusions about students' revision practices were, therefore, based on between-draft revisions (Dave & Russell, 2010). However, evidence from students' revision in Google Docs in the current study shows that they did not compose multiple drafts, but rather single drafts with developmental histories of revision. This has implications for L2 writing research on self-revision. It indicates the need to expand the meaning of a *draft*. It raises two important questions: (a) What is a draft? (b) What should be the unit of analysis for research that focuses on self-revision when students compose using a word processor? A clear conceptualization of what constitutes a draft is important for any research that seeks to analyze students' revisions. Findings from this study affirm the observation that the "on-going revision of a 'single' draft allowed by word processing provides no demarcation between drafts" (Dave & Russell, 2010, p. 410) and suggest that research on self-revision needs to focus on in-process rather than between-drafts revisions in order to unravel the mystery that continues to surround L2 writers' self-revision.

Limitations

Despite these informative findings, the study has some limitations. First, it did not capture textual changes—except the addition of visuals—that students made at the final stage when they used Microsoft Word to format their papers. Students used Microsoft Word for the final revision because it was difficult for them to use Google Docs to format visuals for effective integration. Second, the researcher could not control for all possible factors that might influence noticing. For example, instructor's responses to students' questions about their papers during in-class activities could have facilitated their noticing of problems in their writing. Third, students' comments suggest that pre-writing revisions might have impacted point-of-writing revisions and text quality; however, the study did not analyze the impact of pre-writing revisions on the rest of the writing process. In addition, the software that was used to integrate the listing activity into the writing process did not have spellcheck or grammar-check options. This made grammar correction challenging for the students in this research. Using software that allows for grammar check might be more helpful for low-level students to notice grammar errors unless there is need to control for factors that might influence students' noticing (as was the case in the current study).

Directions for Future Studies

A future study could investigate how pre-writing revisions might influence point-of-writing revisions and text quality. Furthermore, a study that focuses on the challenges the instructor faces in integrating CBMCAs as procedural support might add valuable information to the pedagogical implications of using CBMCAs

in L2 writing classroom. Also, the current study focused on how advanced-low ESL writers used the CBMCAs; further research on how the activities might facilitate noticing and revision for low- and intermediate-level L2 writers might yield findings that will complement those reported here. This will help L2 writing researchers deepen our understanding of how learners with different proficiency levels might benefit from CBMCAs as procedural support for revision as they write to learn a new language. Finally, although one semester (16 weeks) is sufficient time to develop some understanding of how CBMCAs facilitate students' noticing, self-revision, and communication through writing, researching the potential of CBMCAs for a longer duration might yield more findings that will add to what is documented in this study.

Notes

1. All quotations from students are reported verbatim to preserve their voice.

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Appendix A. Guided Reflection on Poster Activity

The following questions are meant to help you reflect on your poster so that you can discover new ideas and strategies that you have expressed in the poster that might help you revise your written draft in Google Docs. In other words, the questions will help you analyze your poster critically and rhetorically, and develop the SUBSTANCE, ORGANIZATION, LANGUAGE and STYLE, of your written draft.

Substance

1. What is the main message (thesis) of this poster? Can you state that in one sentence?
2. What other minor ideas are captured in the poster? Please list them.
3. Who is/are the intended audience?
4. What is the main purpose of the poster?
5. Why did you choose the background color that you did?
6. Why did you use those images and/or videos in the poster?
7. What information do the images/videos give that is not already in your written draft?
8. Comparing your written draft with your poster, what new information do you think your poster brings to your audience?
9. How will the ideas in the poster help you build on the ideas in your written draft?

Language and Style

10. What words on the poster convey the main message of the poster?
11. Have you included some credible sources about your topic in your poster?

Organization

12. Is the main idea in the poster divided into clear and simple sub-ideas? How?
13. Why did you arrange the materials (words, images, sounds, videos) on your poster the way you did?
14. Is there any idea that contradicts your main message?
15. What questions might your readers raise about your poster? And how would you respond to these questions?
16. How might the organization of ideas in your poster help you organize your ideas in the written draft?

Appendix B. Codes

Code Related to Research Question and Theoretical Framework	Code	Code definition
Poster, Multimodality, and Noticing	PNA	Poster activity and noticing of issues related to ideas
	PNO	Poster activity and noticing of issues related to organization
	PNLS	Poster activity and noticing of issues related to language and style
	COMIP	Comments on how the integration of modes helped noticing and revision (Positive)
	COMIN	Comments on how the integration of modes helped noticing and revision (Negative)
Listening, Multimodality, and Noticing	LNA	Listening activity and noticing of issues related to ideas
	LNO	Listening activity and noticing of issues related to organization
	LNLS	Listening activity and noticing of issues related to language and style
Integration of visual, Multimodality, and Noticing	IVNA	Integration of visuals and noticing of issues related to ideas
	IVNO	Integration of visuals and noticing of issues related to organization
	IVLS	Integration of visuals and noticing of issues related to language and style
Additional Emerging Sub-codes	Tech Diff	The use of technology was difficult
	Tech Easy	The use of technology was not difficult
	CWA	Challenges that students faced while performing the CBMCAs
	IPR	Students initial perception of revisions
	NP of revision	New perceptions that students developed about revision
	FDR	What students reported they focused on during revision
	PR Skills (surface)	Students' description of their previous revision skills as focusing on surface-level revision
	PR Skills (content)	Students' description of their previous revision skills as focusing on content-level revision
	PR Skills (C & A)	Students' description of their previous revision skills as focusing on both content- and surface-level revisions
	FUP	Students mention that they will use the poster activity in their future classes
	FUL	Students mention that they will use the listening activity in their future classes
	FUI	Students mention that they will use will explore integration of visuals in their future classes

Code	Name	Definition	Example
IP	Intersemiotic repetition	The repetition of the same experiential meaning as encoded in the written and visual texts.	*Both a visual and the written text focus on football and same words and phrases are repeated in the visual and the written draft.*
IS	Intersemiotic synonymy	The expression of similar experiential meanings as encoded in the written and visual texts.	*A visual is about people at a beach and the essay is talks about of summer vacations. Similar words are used to describe a holiday experience in the visual and the written text.*
IA	Intersemiotic antonymy	The presentation of opposing or conflicting experiential meanings as encoded in the verbal and visual texts.	*A visual shows people in poverty and is meant to contrast a discussion of a luxurious lifestyle in the written draft.*

Appendix C. Rubrics for Students' Assessing Multimodal Academic Texts

	Exemplary	Mature	Competent	Developing	Beginning
Context	(10) The treatment of topic is original and very thoughtful. It engages reader early and is mindful of audience	(8) The treatment of topic is original and somewhat thoughtful. It engages reader, but not early enough; shows signs of being mindful of audience but can be improved.	(6) Treatment of topic is original but lacks thoughtfulness. Audience is implicit and difficult to find. Engages reader only late in the paper.	(4) Treatment of topic is NOT original and lacks thoughtfulness. Fails to engage audience. In general, the context is insufficient.	(2) Treatment of topic too broad and intro lacks originality. The context seems unrelated to the topic and needs major revision.
Substance	(15) The content is relevant, supporting details are very carefully chosen, appropriate for the topic, and substantial.	(12) The content is relevant, and supporting details are appropriate for the topic, but need to be more specific.	(10) The content is somewhat relevant, supporting details seem too general and needs to be made more appropriate for the topic.	(6) The content seems irrelevant, to the main topic; supporting details seem too general, content not substantial for the topic.	(4) The content seems irrelevant to the main topic; details do not relate to the central idea and seem to be chosen haphazardly.
Organization	(15) Intro provides a very explicit, specific, and clear thesis; and provides overview of organization. Conclusion recasts the thesis -Smooth flow of ideas in the paper; ordered in a logical sequence that effectively guides the reader; each paragraph has a well-supported and clearly-stated main point; There is effective use of transitions	(12) Intro provides thesis that is somewhat clear but not explicit and specific enough. Conclusion recasts thesis but could be improved. -Flow of ideas in the paper could be more effectively sequenced.	(10) Intro provides thesis but lacks clarity, is too general. Conclusion only recasts thesis weakly. -Ideas flow in a logical, cohesive manner but development of ideas needs work	(6) Intro provides thesis which is only implicit and hard to find; and conclusion fails to recast the thesis. Both intro and conclusion need major revision. -Sequence of ideas and paragraphs need major revisions. Topic sentences are NOT well written and fail to focus on the thesis.	(4) Intro is very weak; thesis is undetectable; conclusion seems unrelated to the thesis. -There is no clear sequence of ideas and paragraphs seem aimless and haphazard.
Style: Language and use	(25) Correct, appropriate, and varied integration of textual examples, including in-text citations; limited errors in spelling, grammar, word order, word usage, sentence structure, and punctuation; good use of academic English	(23) Correct, appropriate, and some integration of textual examples, including in-text citations; However, there are some FEW errors	(20) Correct and appropriate integration of textual examples, including in-text citations; However, MANY errors per page Major problems with using academic English	(15) MOSTLY incorrect sentences structures integrating textual examples, including in-text citations; several errors per paragraph informal language used in multiple instances	(10) Pervasive incorrect sentence structures integrating textual examples; no in-text citations; many errors that IMPEDE comprehension throughout the paper; informal or inappropriate language use.

Intersemiotic Complementarity	(25) The integration of verbal and visual texts shows effective encoding of same experiential meaning (Repetition); or similar experiential meaning (Synonymy); or opposing/Conflicting meanings. Or, all three meanings are effectively encoded.	(23) The integration of verbal and visual texts shows a good encoding of same experiential meaning (Repetition); or similar experiential meaning (Synonymy); or opposing/Conflicting meanings. Or, all three meanings are encoded but need some revision to be effective.	(20) The integration of verbal and visual texts shows some somewhat a fair encoding of same experiential meaning (Repetition); or similar experiential meaning (Synonymy); or opposing/Conflicting meanings. Or, all three meanings are fairly encoded.	(15) The integration of verbal and visual texts shows a weak encoding of same experiential meaning (Repetition); or similar experiential meaning (Synonymy); or opposing/Conflicting meanings. Or, the encoding of meanings needs major revision.	(10) There is no clear integration of verbal and visual texts. Or an attempt at encoding of same experiential meaning (Repetition); or similar experiential meaning (Synonymy); or opposing/Conflicting meanings is confusing.
Delivery	(10) Consistency in typography and headings, page layout makes the paper easy to read. Cites sources using APA or MLA style. Visuals are well integrated text.	(8) Consistency in typography and headings, but displays minor problems with page layout and citing of sources using APA o MLA style. Displays minor problems with visual integration.	(6) There is some consistency in typography and headings, but displays some problems with page APA or MLA style, and integration of visuals.	(4) Major problems with typography and headings. Display major problems with APA and MLA style. Displays problems with the integration of visuals.	(2) There is no consistency in typography and headings; it displays major problems with page layout. There is no integration of visuals. Overall layout severely impedes comprehension.

About the Author

Richmond Dzekoe is a Visiting Assistant Professor of English at Miami University, Oxford, OH. He holds a PhD in TESL/Applied Linguistics and Technology from Iowa State University. His research interests include English for academic purposes, CALL, multimodal communication, and second language writing.

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