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L2 Learners' Cognitive and Behavioral Engagement with Written Corrective Feedback

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The purpose of this study was to explore the relationship between students' cognitive engagement with written corrective feedback (WCF) and their revision behavior. Based on the assumption that different levels of cognitive involvement are linked to learners' use of the feedback, we investigated how different post-feedback activities (i.e., reading, copying, and explaining the feedback) would affect second language writers' behavioral engagement with WCF during the revision phase. Ninety-eight students were divided into three experimental groups and one control group. Experimental groups performed one of the three post-feedback activities before revising their original writing. The participants' revision behavior was examined by their uptake of WCF. Additionally, the change in writing quality between the first and the revised drafts was investigated. Results showed that activities that promote deeper cognitive processing generally led to higher uptake of WCF in revision. The effects of post-feedback activities, however, varied for error types. All the post-feedback activities were effective in improving the quality of writing.

Key words: second language writing, written corrective feedback, cognitive engagement, behavioral engagement, writing quality

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1. INTRODUCTION

The use of written corrective feedback (WCF) has been a central topic in the field of second language (L2) writing ever since a review on the role of WCF in L2 acquisition was published by Truscott (1996). Despite earlier disagreement on its effectiveness in assisting L2 acquisition (Ferris, 2010), WCF constitutes a major object of inquiry in the field (Ellis, 2010). From a pedagogical perspective, WCF is the most widely used type of feedback in real-world classrooms (Van Beuningen, De Jong, & Kuiken, 2012; Zheng & Yu, 2018), and L2 learners also expect to receive WCF from their writing instructors (Chandler, 2003; Zhang, 1995). Attempting to investigate whether WCF helps improve the quality of L2 writing, studies on whether certain types of WCF are more beneficial than others by comparing different types of feedback (e.g., Sheen, 2007) and whether it would be more effective to focus on a certain number of errors or give comprehensive feedback (e.g., Ellis, Sheen, Murakami, & Takashima, 2008; Frear & Chiu, 2015) have been conducted. These studies primarily focused on how to give feedback from the teachers' perspectives. However, as Ellis (2009) pointed out, accounts of corrective feedback (CF) need to consider not only teachers' strategies for providing CF but also students' response to the feedback, as CF can have an impact only if the students attend to it. There are studies that addressed this aspect by focusing on students' affective engagement with WCF (Hyland, 2003; Lee & Schallert, 2008; Storch & Wigglesworth, 2010). These studies investigated learner engagement with WCF by looking into learners' attitudes toward or perception of the feedback. A few researchers observed the process of students' cognitive interaction with the feedback and students' revision behavior using a case-study design (Qi & Lapkin, 2001; Storch & Wigglesworth, 2010). However, few attempts have been made to examine the direct link between different levels of students' attention to the feedback and their use of the feedback in the revision process. The present intervention study addresses this gap by examining the effects of encouraging learners to deal with teachers' WCF in different ways with varying levels of cognitive engagement on their revision behavior. By doing so, we aim to explore the relationship between students' cognitive and behavioral engagement with WCF.

2. LITERATURE REVIEW

2.1. Learner Engagement with WCF

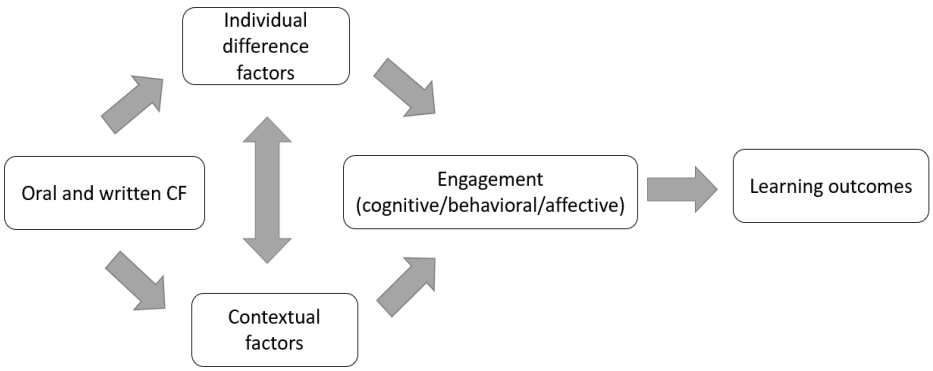
Several researchers have pointed out that learners' response to WCF is relatively understudied. Ellis (2009) claimed that the way L2 writers react to the given feedback is important although previous studies mostly focused on the feedback that instructors give to

L2 writers. Guénette (2007) also emphasized the role of learners' engagement with CF in increasing the efficacy of CF. She argued that for any type of feedback to work successfully, learners must notice the feedback and have abundant opportunities to apply the corrections. Storch and Wigglesworth (2010) argued that how learners engage with and process the feedback, and why they use the feedback received need to be investigated.

To identify variables relevant for CF research, including learner-related factors, Ellis (2010) introduced a framework for investigating oral and written CF. The relationships between CF and learner engagement, and between engagement and learning outcomes are presented through the framework (see Figure 1).

FIGURE 1

A Componential Framework for Investigating CF (Adapted from Ellis, 2010)



Ellis defined the notion of engagement as "how learners respond to the feedback they receive" (Ellis, 2010, p. 342). He argued that CF types, individual difference factors, and contextual variables influence how learners respond to the feedback. He also argued that engagement could be examined from three perspectives: cognitive, behavioral, and affective. Cognitive engagement is related to how students attend to the CF; behavioral engagement focuses on whether and in what ways learners respond to the CF (e.g., uptake of oral corrections or revision of the written texts); and affective engagement refers to how learners respond attitudinally to the CF (e.g., they feel anxiety). In the framework, learner engagement leads to final learning outcomes. Learning outcomes are generally measured by accuracy of the learners' outcomes of exposure to the CF in both oral and written modes.

Based on the framework proposed by Ellis (2010), several studies have investigated how L2 learners engage with WCF. Some of them are reviewed in the following section.

2.2. Empirical Research on Learner Engagement with WCF

Although learners' response to and engagement with the teacher feedback is a relatively new topic in the field, WCF research has extensively focused on the extent to which learners incorporate the given CF in revising their writing. As Storch and Wigglesworth (2010) state, "The bulk of research on feedback has investigated the type of revisions that students make (or do not make) in response to different types of feedback" (p. 305). In light of Ellis's (2010) framework for learner engagement with feedback, this line of research dealt with the behavioral dimension of learner engagement. However, the focus was more on the teachers' perspective than that of the learners. Students' application of feedback, also referred to as uptake of feedback, has been employed as a measure of effectiveness of feedback. Research in this domain investigated whether certain types of CF are more beneficial than others by comparing different types of feedback (e.g., Bitchener & Knoch, 2009; Sheen, 2007) or whether effects of focusing on certain types of errors or giving comprehensive feedback vary (e.g., Frear & Chiu, 2015). The type of feedback was understood to be more effective when students applied more feedback successfully in revising their draft.

Some researchers focused more on the learner-internal process during which L2 learners use the teacher-provided CF. They investigated the students' cognitive process in using the feedback and examined the impact of learners' noticing of feedback on their writing improvement. In Qi and Lapkin (2001), the participants were given reformulation feedback and asked to think aloud while comparing the differences between the original draft and the reformulated version. The participants then revised the original draft. The authors revealed that substantive noticing, which was assumed to occur when the learners could provide reasons for the change, led to greater improvements in the revised text than perfunctory noticing. Similarly, Sachs and Polio (2007) found, also through think-aloud protocols, that learners were more successful in revising an item when they noticed and understood why the linguistic item was reformulated. The researchers argued that metalinguistic verbalization promotes attention to and deeper processing of the feedback, which in turn leads to improved writing quality. Storch and Wigglesworth (2010) analyzed learners' collaborative dialogues on the given WCF. The feedback was given either in the form of reformulations or editing symbols. The researchers found that coding symbols induced more language related episodes (LREs), which in turn helped learners retain the feedback longer. To summarize, all these studies confirmed the importance of learner processing of the feedback for its retention.

Furthermore, several recent case studies explored learners' cognitive strategies in processing WCF along with behavioral and affective dimensions of engagement using multiple sources of data. These studies investigated how L2 learners engage with WCF specifically based on the framework proposed by Ellis (2010). Han and Hyland (2015)

investigated how four Chinese English as a foreign language (EFL) learners engaged with the WCF from the cognitive, behavioral, and affective perspectives. The results showed the complexity of learner engagement within and across the three dimensions. For example, one participant showed effective revisions based on her thorough understanding of errors; two other participants also showed effective revisions, but their cognitive engagement with the WCF was surface level. The researchers suggested that it might be the result of the learners' effective use of other resources such as online dictionaries and learning strategies including avoidance strategies. Similarly, Zheng and Yu (2018) investigated twelve lower-proficiency Chinese EFL learners' cognitive, behavioral, and affective engagement with teacher-provided WCF. The results highlighted the complex relationship between the learners' affective engagement and their behavioral and cognitive engagement. For instance, the participants showed a positive affective engagement with the WCF, but their behavioral engagement did not necessarily result in greater language accuracy in revisions. Additionally, the participants showed scant awareness of the WCF, especially in the case of indirect WCF. Zheng, Yu, and Liu (2020) explored how two lower-proficiency Chinese EFL students engaged with their teacher's WCF. The study highlighted that individual factors such as student beliefs and goals, and the contextual factor of teacher-student relationship, led to individual differences in the students' behavioral, cognitive, and affective engagement.

As mentioned above, studies on learners' cognitive engagement with WCF have found that deeper cognitive processing might result in better learning (e.g., Qi & Lapkin, 2001; Sachs & Polio, 2007; Storch & Wigglesworth, 2010) and that there are individual variations in the depth of engagement (e.g., Han & Hyland, 2015). It would then be beneficial, from a pedagogical perspective, to explore ways to promote learners' cognitive involvement with the WCF to help them benefit more from the feedback. However, only a few attempts have been made to tackle this issue. We could identify only a couple of studies, in which the researchers manipulated learner reaction to WCF. They both employed written languaging. Languaging is "the process of making meaning and shaping knowledge and experience through language" (Swain, 2006, p. 98). Oral languaging can occur in the form of collaborative talk or self-explanation. Written languaging involves the process of writing down the explanations of the given instructional materials (Suzuki, 2012). Based on the assumption that written languaging leads to deeper processing by having learners make inferences and adjust their knowledge structure, Suzuki (2012) and Moradian, Miri, and Hossein Nasab (2017) investigated its effects on the efficiency of WCF. Suzuki (2012) required his participants to write explanations for the corrected errors. Learners were asked why the linguistic forms were incorrect or why the instructor gave feedback on them. He found that the opportunity to reflect on the given WCF helped learners successfully correct the errors during immediate revision. Moradian et al. (2017) also asked their participants to write down reasons behind the errors after receiving direct WCF. They found that languaging

led to greater accuracy gains in the post-test.

The benefit of reflecting on the given feedback was also mentioned by Sachs and Polio (2007). However, not every error correction seems to require deep processing to be retained. Simply reading the errors may involve ample amount of noticing. Storch and Wigglesworth (2010) found that feedback on mechanic errors was retained despite limited or no overt engagement—one student in the pair read the feedback and the other repeated or simply acknowledged it. The result suggests that for some errors, reading the corrections may result in successful uptake. This is an interesting issue to be investigated empirically.

The rationale of the present study comes from the lack of previous research in the field. Relatively fewer researchers focused on the issue of learners' reaction to the given WCF than on instructors' provision of feedback, while a bulk of research exists on how to give feedback from instructors' perspective. A few studies have revealed that learners' level of attention to the WCF (i.e., the level of cognitive engagement) affects the usefulness of the feedback. However, to our knowledge, intervention studies that compared the effects of different types of learner engagement with WCF have been scarce.

In line with the recent case studies on learner engagement with WCF and following Ellis's (2010) conceptualization, we also view learner engagement with WCF as composed of three dimensions: cognitive, behavioral, and affective. Among these three, our focus is on the cognitive and behavioral perspectives. In our study, behavioral engagement concerns learners' actual use of the teacher's WCF in revising their draft (i.e., uptake). Cognitive engagement is defined as how learners attend to the WCF and operationalized in terms of what learners do during post-feedback activities. We assume that simply reading the feedback, writing down the feedback, and explaining reasons behind the feedback involve different levels of cognitive processing. As Sachs and Polio (2007) and Suzuki (2012) indicated, we assume that having learners reflect on the reasons behind the feedback (i.e., metalinguistic verbalization or languaging) involves deeper cognitive processing than having them read or copy the feedback. We also assume that rewriting to reflect corrections involves higher cognitive engagement than simply reading, given that the task requires students to both read and write the WCF.

The present study intends to add to the literature by examining the relationship between cognitive and behavioral engagement with WCF. The study also investigates the relationship between cognitive engagement with WCF and an improvement in overall writing quality. Specific research questions addressed are as follows.

1) How do post-feedback activities, designed to involve learners' cognitive engagement with WCF (reading, copying, and explaining the feedback), affect their behavioral engagement with WCF (i.e., uptake in revision)?
2) How do post-feedback activities affect the quality of revised writing?

3. METHODS

3.1. Settings and Participants

The participants were 98 first-year students (41 males and 57 females; aged 19–21) enrolled in an English composition class at a public university in Seoul, South Korea. This course was designed to help students build foundational skills for academic writing in English. On the course, the students learned how to construct basic paragraph and essay structures through several writing practices. The students learned how to write, review, and revise their writing in the writing process with the help of teacher and peer feedback. The students also learned useful grammar patterns and formal expressions for academic writing. The students agreed to participate in the study by signing the consent form. They were recruited from four different existing classes, each of which consisted of students from either one or several different majors. Employing a quasi-experimental design, we randomly assigned the four classes to three experimental groups and one control group. The three experimental groups performed post-feedback activities designed to encourage different types of cognitive engagement with teacher WCF (i.e., reading, copying, and explaining). The participants' general English proficiency levels ranged from the Common European Framework of Reference for Languages (CEFR) level A1 to C1. Their proficiency level was based on their first pieces of argumentative writing, which were evaluated by an automated writing evaluation tool provided by the Cambridge Write & Improve tool (https://writeandimprove.com/). A Kruskal-Wallis test was performed to determine if the classes were comparable in terms of their writing proficiency. The result confirmed that there was no significant difference among the classes (χ^2 (3) = 3.09, p = .38). Table 1 shows the distribution of the participants.

TABLE 1

Participants

Group	Number of Participants		
	Male	Female	Total
Experimental			
Reading	9	19	28
Copying	15	12	27
Explaining	8	14	22
Control	9	12	21
Total	41	57	98

3.2. Writing Task and WCF

We asked the students to write an argumentative paragraph on wearing uniforms in high

school. We provided unfocused direct feedback on their writing in accordance with the general practice of the course. We attempted to identify all the errors made by students and wrote explicit corrections next to the errors.

3.3. Procedures

A total of three experimental sessions were held in the middle of a 16-week semester in the fall of 2019. Figure 2 shows the overall design of the study. Before the first writing session, the students learned how to organize narrative, process, definition, cause/effect, comparison/contrast, and argumentative paragraphs by reading and analyzing model paragraphs. In fact, the participants had a chance to write a narrative paragraph and revise it based on the feedback given by their peers and teacher before joining the experimental sessions.

In the first session (Week 10) of the study, the participants were given 30 minutes to write an argumentative paragraph about their opinions on uniforms for high school students. All their writings were collected at the end of the session. After the session, the researchers of this study gave written direct and unfocused (comprehensive) CF on the writings.

The researchers, who are experienced non-native English instructors, gave feedback on students' grammar, lexical, and mechanic errors. The errors were marked (underlined or circled) on the students' original drafts, and the correct forms were provided. The corrections were given mostly at a word or phrase level when necessary. Following Sachs and Polio's (2007) error coding and correction procedure, the researchers did not change the order of sentences or insert new sentences.

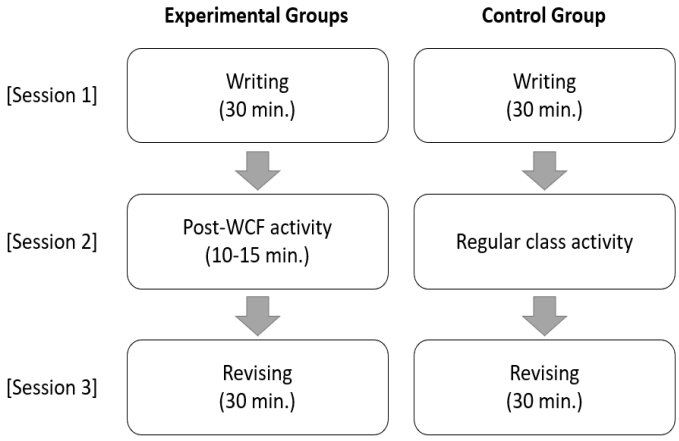
The second session of the study was held three weeks after the first session (Week 13). The original drafts with the WCF were returned to the students. In addition, a post-feedback activity was assigned to each experimental group, inviting students to process the WCF given on their original drafts. The students in the control group were not assigned any post-feedback activity. The reading group participants read the feedback for 10 minutes. They were instructed to read the original drafts and the given CF silently and carefully. They were also not allowed to write down any notes. The copying group participants were given a clean page. They were asked to copy their original drafts by revising the errors in 15 minutes. The explaining group participants reflected on their errors by writing down their own explanations for the corrected errors in 15 minutes. They were allowed to write "I don't know" if they did not understand why a certain CF was given. In addition, they were given the option to write down their explanations in either Korean, their native language, or in English. After the participants completed the post-feedback activities, all the materials used for the activities and their initial written pieces with the marked feedback were collected. However, the students in the control group were allowed to keep their initial written pieces

with the marked feedback. In other words, they were freely given a chance to review their feedback at home, although there was no explicit instruction for any type of post-feedback activity. The reading group was given less time than the other groups to process the given CF, considering the nature of the written modality. According to Williams (2012), equalizing time may detract from the authenticity when the written production in nature requires more time than other modalities. It definitely takes more time to write than to read the same amount of feedback. This issue was addressed in the pilot study as well. The pilot study was conducted with another group of first-year students at the same university in the previous semester. In the pilot study, participants in each of the three experimental groups were given 10 minutes; however, it was not enough time for the copying and explaining group students and they needed a few more minutes. However, the reading group participants did not need more than 10 minutes. Considering the nature of the written modality, allowing more time to groups whose task involves writing seems acceptable.

The final (third) session was held a week after the second session (Week 14). The participants were given a copy of their unmarked original pieces written in the first session and asked to revise them in 30 minutes.

FIGURE 2

Procedures



3.4. Data Analysis

3.4.1. Analysis of student errors and WCF

The errors were coded and corrected by the researchers. They first worked individually and then together to sort out any disagreement. Learner errors were categorized into three

groups: grammar, lexical, and mechanic errors. Grammar errors included incorrect use of grammatical morphemes such as articles, plural marker *-s*, past tense marker *-ed*, and wrong sentence structures. For grammatical morpheme errors, not only wrong instances but also omission errors were counted. Lexical errors were operationalized as the inappropriate use of words or phrases, for example, preposition errors or incorrect vocabulary use. Finally, a word spelled incorrectly was considered a spelling error. It constructed mechanic errors together with punctuation and capitalization errors.

3.4.2. Analysis of students' behavioral engagement with WCF

The main purpose of the present study was to investigate whether different levels of cognitive engagement with WCF would affect students' behavioral engagement with the feedback. Students' revision behaviors were measured by instances of feedback uptake in the revised draft. Uptake of the feedback, in other words, applications of the CF, was analyzed for whether it was successful, unsuccessful, or avoided. Instances of uptake were coded as successful when students applied the exact corrections in the revised draft, and as unsuccessful when they did not. Uptake of the feedback was counted as "avoided" when the exact same words, phrases, or structures were not used in the revised writing. For example, a student wrote the sentence, "I think school uniform is needed for high school students." WCF was given as "uniforms are" for "uniform is." In this case, when the student applied the exact correction in the revision, it was coded as an instance of successful uptake. When the student did not apply the correction in the revision, it was an instance of unsuccessful uptake. Lastly, when the student rephrased the sentence as "I think high school students need school uniform," it was considered as avoided uptake.

The frequencies and ratios of successful, unsuccessful, and avoided uptake were compared across groups. In order to investigate the relationship between cognitive and behavioral engagement with WCF statistically, chi-square analyses were conducted.

3.4.3. Analysis of students' quality of writing

The study also aimed to investigate the differences in quality of writing between the first and the revised drafts. All the first and revised drafts were typed and electronically stored. Then the paragraphs were rated by an automated writing evaluation tool provided by the Cambridge Write & Improve tool (https://writeandimprove.com). The evaluation was first presented as CEFR levels, and then the measured CEFR levels were converted to numeric scores of the International English Language Testing System (IELTS). Guided by the IELTS website (https://www.ielts.org/about-ielts/ielts-in-cefr-scale), we converted A1 to 2.5, A2 to 3.5, B1 to 4.5, B2 to 5.5, and C1 to 7.5.

In order to investigate the change in writing quality, we examined the difference in the mean score between the first and the revised drafts by group. As the assumption for a normal distribution was not met, we performed a series of non-parametric Friedman tests using jamovi (The jamovi project, 2021).

4. FINDINGS

4.1. Overview of WCF by Error Types

In order to see whether different post-feedback activities had varied influence on uptake of CF for different types of errors, we first counted the number of errors for which the researchers gave corrections. Table 2 shows the number of corrections by each type of error that appeared in the first draft. The corrections were analyzed for different groups as well. The most frequent errors related to grammar for all four groups (55.8% of the total number of errors), followed by lexical (24.2%) and mechanic (20.0%) errors. Most of the mechanic errors were spelling errors.

TABLE 2

Frequency Distribution of WCF by Error Type

Group	Grammar	Lexical	Mechanic	ALL
Reading	300	147	106	553
	54.2%	26.6%	19.2%	100%
Copying	279	92	101	472
	59.1%	19.5%	21.4%	100%
Explaining	184	64	39	287
	64.1%	22.3%	13.6%	100%
Control	216	122	105	443
	48.8%	27.5%	23.7%	100%
Total	979	425	351	1755
	55.8%	24.2%	20.0%	100%

4.2. Learners' Uptake of WCF

Evidence of uptake was traced in the revision writing task. Looking at the data holistically, 43.8% of the corrections (768 out of 1,755) given by the researchers were successfully implemented in the revised draft, while 41.9% of the errors remained unchanged; 14.4% of the corrections were not applied, instead, the phrases including the errors were removed or rephrased. Among the three error types, mechanic errors were the most successfully corrected (47.0% of the corrections were successfully implemented in the revised draft). For

grammar errors, the successful uptake accounted for 45.6% of all uptakes. Lexical errors were corrected the least overall (36.9%) and were rephrased the most (17.5%). The trends in uptake were identified for all three experimental groups (see Table 3).

4.3. Effects of Post-feedback Activities on Learners' Uptake

In order to investigate whether different post-feedback activities affected students' uptake behaviors, we counted the number of instances of uptake (successful, unsuccessful, avoided) by error type. Table 3 presents the observed and expected frequency distributions and the percentages of successful, unsuccessful, and avoided uptake for each error type. Overall, post-feedback activities that involved writing were found to lead to higher uptake in the revision. The ratio of successful uptake to the total number of errors was highest in the copying group (51.9%), followed by the explaining (49.8%), reading (38.3%), and control groups (37.9%).

TABLE 3

Uptake of CF by Group and Error Type

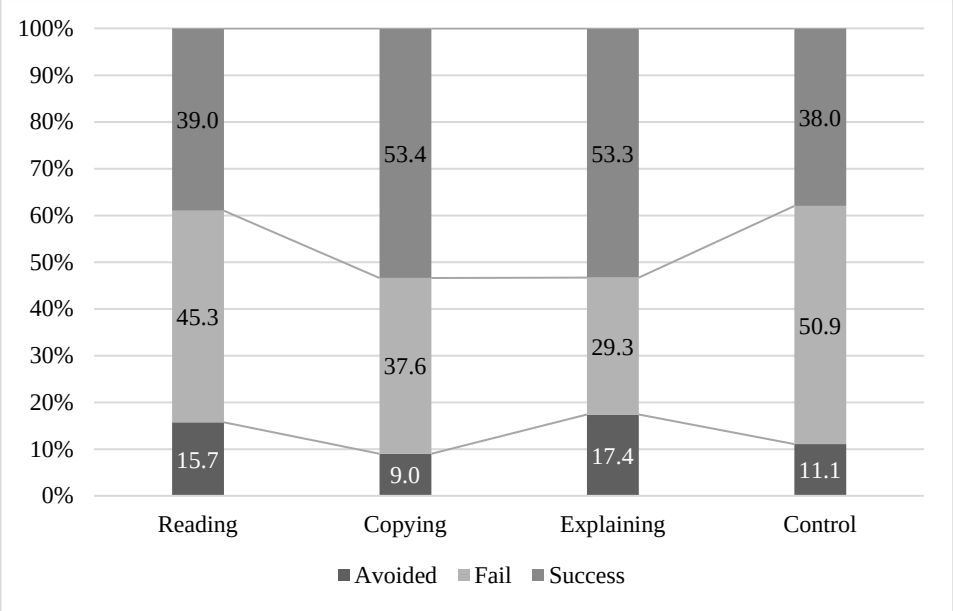
Group		Error type											
		Grammar				Lexical				Mechanic			
		Avoided	Fail	Success	TOTAL	Avoided	Fail	Success	TOTAL	Avoided	Fail	Success	TOTAL
Reading	Freq[a]	47	136	117	300	36	59	52	147	19	44	43	106
	Exp[b]	39.2	124.1	136.7	300	25.9	66.8	54.3	147.0	14.8	41.4	49.8	106
Copying	Freq	25	105	149	279	11	42	39	92	11	33	57	101
	Exp	36.5	115.4	127.1	279	16.2	41.8	34.0	92.0	14.1	39.4	47.5	101
Explaining	Freq	32	54	98	184	13	27	24	64	4	14	21	39
	Exp	24.1	76.1	83.8	184	11.3	29.1	23.6	64	5.4	15.2	18.3	39
Control	Freq	24	110	82	216	15	65	42	122	15	46	44	105
	Exp	28.2	89.4	98.4	216	21.5	55.4	45.1	122	14.7	41.0	49.4	105
Total	Freq	128	405	446	979	75	193	157	425	49	137	165	351

Note. [a]Freq = observed frequency; [b]Exp = expected frequency

A chi-square test confirmed the significance of the relationship between the post-feedback activities and uptake of WCF for grammar errors, χ^2 (6, N = 979) = 33.4, $p < .001$. Both the copying and explaining group participants implemented about 53% of the WCF successfully in revising their draft (see Figure 3). If not corrected successfully, 17.4% and 9% of the errors in the original draft were removed or rephrased by the explaining group and the copying group, respectively. The reading group's successful uptake ratio (39.0%) was lower than that of the other experimental groups and similar to that of the control group (38.0%). The avoidance ratio of the reading group (15.7%) was higher than that of the copying group (9.0%) and the control group (11.1%).

FIGURE 3

Uptake of Grammar Errors



For the mechanic errors as well, both the copying and explaining groups applied over half of the WCF successfully in the revised draft (successful uptake ratio was 56.4% and 53.8%, respectively). The reading group had a successful uptake ratio of 40.6%, similar to that of the control group (41.9%). The avoidance ratio was the highest for the reading group (17.9%), followed by similar ratios for copying and explaining groups (10.9% and 10.3%, respectively). The relationship between uptake of feedback for mechanic errors and post-feedback activities was not significant, χ^2 (6, N = 351) = 8.01, p = .24 (see Figure 4).

FIGURE 4

Uptake of Mechanic Errors

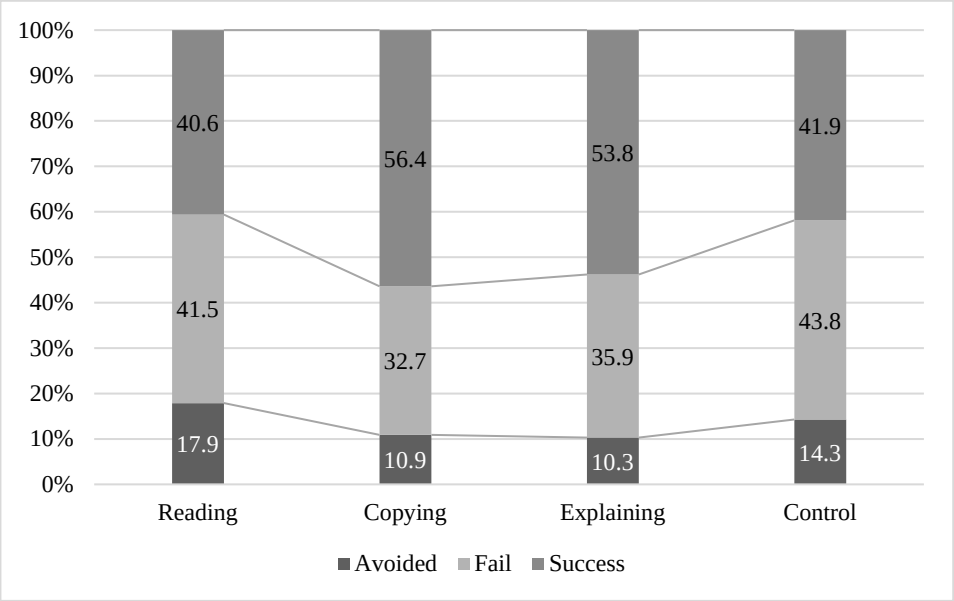
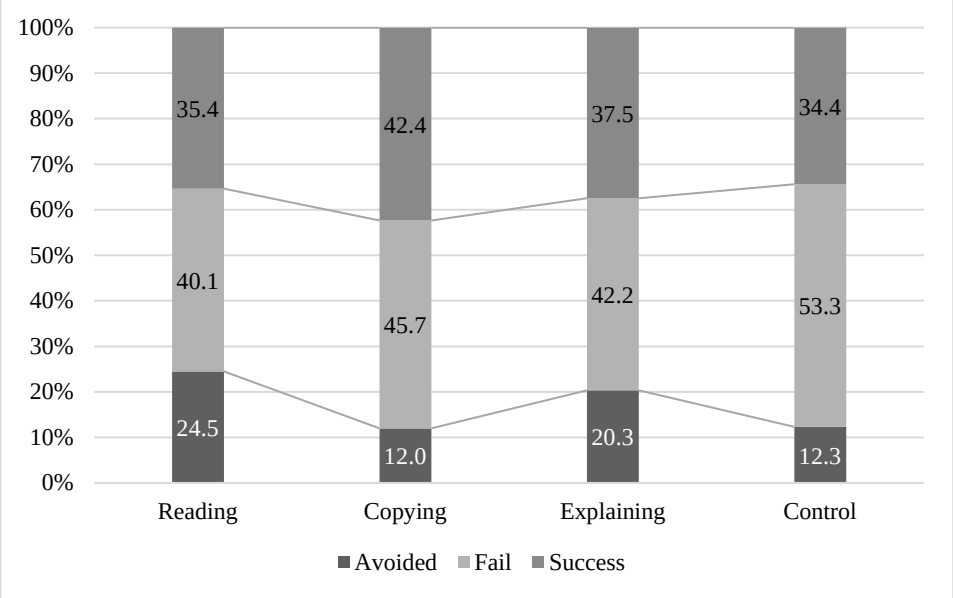


FIGURE 5

Uptake of Lexical Errors



For lexical errors, all the experimental groups showed the lowest successful uptake ratios and the highest avoidance ratios among the three error types. The copying group still showed the highest successful uptake ratio of all (42.4%), while the other groups accepted less than 40% of the corrections. The reading and explaining groups rephrased or removed over 20% of the errors of the original draft. The chi-square statistic was not significant for this type of errors as well, χ^2 (6, N = 425) = 11.6, p = .07 (see Figure 5).

4.4. Differences in the Quality of Writing

In order to see the differences in the quality of writing between the first and the revised drafts, we conducted the Friedman test, the non-parametric one-way ANOVA with repeated measures. Table 4 shows the mean scores of the first draft and the revised draft for the four different groups, with the χ^2, *df*, and p values from the Friedman test result. The Friedman test showed that there was a significant difference between the mean scores of the first draft and the ones of the revised drafts in all experimental groups: the reading group (χ^2 (1) = 6.40, p <.05), the copying group (χ^2 (1) = 4.50, p <.05), and the explaining group (χ^2 (1) = 7.00, p <.01). However, there was no significant difference between the mean score of the first draft and the revised drafts in the control group (χ^2 (1) = 2.00, p >.05).

TABLE 4

The Descriptive Statistics and the Friedman Test Result

Group	Mean (First draft)	Mean (Revised draft)	χ^2	*df*	*p*
Reading	3.64	3.93	6.40	1	0.011*
Copying	3.39	3.61	4.50	1	0.034*
Explaining	3.41	3.73	7.00	1	0.008**
Control	3.64	3.83	2.00	1	0.157

Note. *p <.05, **p <.01

We also examined the number of paragraphs in which scores changed after revision. Table 5 summarizes the percentage of students whose revised drafts were improved, maintained, or unimproved. Among the three experimental groups, the reading group and the explaining group showed a higher percentage of students who showed improvement in their revised drafts (32.14% and 31.82%, respectively), while the copying group showed a lower percentage of students who showed improvement in their revised drafts (25.93%). However, the copying group showed the highest percentage of students who maintained the quality of writing in their revised drafts (70.37%). In other words, in all three groups, the percentage of students whose revised drafts were unimproved was quite low (3.57%, 3.70%, and 0%, respectively). For the control group, the percentage of students whose revised drafts were

improved was lower (28.57%), and the percentage of students whose revised drafts were unimproved was higher (9.53%). This higher percentage of unimproved students only in the control group might be related to the result of the Friedman test.

TABLE 5

Percentage of Students Showing Changes in Revision

Group	Improved(%)	Maintained(%)	Unimproved(%)	Total(100%)
Reading	32.14	64.29	3.57	100
Copying	25.93	70.37	3.70	100
Explaining	31.82	68.18	0.00	100
Control	28.57	61.91	9.53	100

5. DISCUSSION

The present study was guided by two research questions: 1) how post-feedback activities, designed to involve learners' cognitive engagement with WCF (reading, copying, and explaining the feedback), affect their behavioral engagement with WCF (i.e., uptake in revision) and 2) how post-feedback activities affect the quality of revised writing.

Overall, the percentage of uptake in the participants' revisions showed that about 44% of the corrections were successfully implemented, 42% of corrections remained unchanged, and about 14% of the corrections were removed or rephrased. More specifically, among the three error types, mechanic errors were the most successfully corrected, followed by grammar and lexical errors. This finding suggests a relation between the level or type of processing needed for the uptake of feedback and types of errors. The results support Storch and Wigglesworth's (2010) argument that "feedback on errors in mechanics are retained despite limited or no overt engagement and morphosyntactic errors requiring high levels of engagement leads to understanding and an ability to retain the feedback in the long term" (p. 328).

The first question relates to the link between the participants' behavioral and cognitive engagement with WCF. The different post-feedback activities with varying levels of cognitive engagement seem to lead to the participants' different uptake behaviors. The two groups whose post-feedback activities involved writing (copying or explaining) showed higher uptake compared to the other two groups who either only read the corrections or were not involved in any activity. This result supports the idea of different depths of processing discussed by Qi and Lapkin (2001), Sachs and Polio (2007), and Han and Hyland (2015). They discussed that learners' awareness at the deeper level (i.e., understanding) should be distinguished from their awareness at the surface level (i.e., noticing). In rewriting the

corrected sentences and explaining the reasons for the corrections, the learners could not only recognize the teachers' corrective intention and attend to the correct forms, but also provide accurate metalinguistic explanations of their errors and corrections (Han & Hyland, 2015).

Furthermore, the relationship between the participants' behavioral and cognitive engagement with WCF was observed in terms of error types. For grammar errors, the rate of successful uptake was higher in the two groups that engaged in copying and explaining. It is noteworthy that the rate of avoidance was higher in the explaining group than in the copying group. This may be due to that the level of cognitive engagement required for copying the corrected version of their writings is lower than that required for providing accurate metalinguistic explanations. It is possible that the participants simply memorized the corrections while rewriting them without any in-depth understanding. As for mechanic errors, the rate of successful uptake was again higher in the two groups involved in copying and explaining in the post-feedback activities. The rate of avoidance was also similar in both groups. It might be possible that even the explaining group would not need to be engaged with the deeper level of cognitive process for the mechanic errors (mostly spelling errors) as argued by Storch and Wigglesworth (2010). Finally, for lexical errors, the rate of avoidance in all three experimental groups was the highest among the three error types. It might be possible that the cognitive processes that are required for lexical errors are different from those required for grammar or mechanic errors. Interestingly, among the three experimental groups, the reading and explaining groups showed higher rates of avoidance than the copying group. Similar to the case of grammar errors, it seems that the level of cognitive engagement required for copying the corrected version of their writings is lower than that required for providing accurate metalinguistic explanations of their errors and corrections. Again, it is possible that the participants simply memorized the corrections while copying them without giving the WCF any deeper thought.

The second research question asked about the effects of post-feedback activities on the overall revision quality. All the experimental groups showed significant improvement in revision, but not the control group. The results suggest that encouraging learners to process and attend to teacher WCF is important.

6. CONCLUSION

This study was conducted to understand the effects of directing learners' attention to WCF by guiding them to react to the given feedback in three different ways. The findings indicate that the processing of feedback may relate to the effects of feedback in terms of uptake in the revision and overall quality of the revision. It was also revealed that not all types of errors

require the same level of processing. However, these findings should be interpreted with caution. In this study, we used natural classes established by the university in setting up the control and experimental groups. Although we tried to match the proficiency level among classes, we could not incorporate randomization. Therefore, the composition of the classes may have affected the results.

Furthermore, uptake of WCF should also be interpreted cautiously. In the present study, we focused on whether learners' cognitive engagement with WCF is linked to their behavioral engagement. However, it should be noted that theoretical significance of uptake is controversial (Ellis, 2010). Some interactionists argue that uptake does not lead to acquisition. Thus, successful uptake of WCF in revision does not necessarily imply that the learners learned or acquired the related linguistic features. In a further study, we plan to investigate whether the effects of WCF are retained in a new writing task to address this issue. Future studies can also consider employing other measures such as overall accuracy rates to gauge the effects of WCF and having a delayed revision task.

Future studies may also look into the interaction between types of feedback (e.g., direct correction vs. coded feedback) and types of post-feedback activities, and their effect on accuracy gains for different types of errors (grammar, lexical, and mechanic). Storch and Wigglesworth (2010) argued that different types of feedback elicited different levels of feedback processing. They found that editing feedback elicited more LREs than reformulations and that these LREs tended to relate directly to the feedback provided. The level of engagement was also more extensive with editing feedback than in response to reformulations. It is possible that a certain post-feedback activity works best with a given type of feedback for different types of errors. We believe that studies on WCF from learners' perspective (i.e., learners' response to CF) may not only bridge the gap in research but also help teachers and learners make informed decisions on how to give and use the WCF.

Applicable levels: Tertiary

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