On-Line Revision Behaviors in EFL Writing Process

Yeon Hee Choi
(Ewha Womans University)


This study aims at investigating Korean EFL college students’ online revisions of writing in English, using a software program (*Inputlog*) for recording keyboard activity and compose-aloud protocols with retrospective interviews. It also examines the impact of L2 writing proficiency on their revision behaviors and the relationship of writing quality with revisions. The results of the study illustrate a high frequency of external revisions; more formal revisions than content revisions; a greater frequency of substitution revisions over any other action types; a high frequency of graphical and lexical changes; and a small number of distant revisions. The comparison between higher- and lower-level students reveals some impact of their proficiency on revisions: while lower-level students changed vocabulary very often, higher-level students made more global-level revisions (content-related revisions, and phrasal and clausal revisions) and did not revise before typing as frequently as lower-level students. No significant correlation was noted between writing quality and the frequency of revisions across types; however, the results of the correlation analysis suggest that the EFL writers who revise more, especially when they make higher-level revisions, improve their text. Interestingly, the higher-level students who revised less had better text quality. These findings imply an influence of writing proficiency on online revisions, not only between proficiency groups but also within the same proficiency group.

I. INTRODUCTION

Writing process in second language (L2) has been a key research area due to the impact of process-oriented approach to writing since the 1980s. One of the main research topics is revising and feedback (Berg, 1999; Fathman & Walley, 1990; Ferris, 1995, 1997; Hyland, 1998; Kobayashi & Rinnert, 2001; Sengupta, 2000). Most of the previous studies have analyzed L2 writing on paper. Revision behaviors can vary with writing modes, as van Waes and Schellens (2003) state that writing processes including revising are influenced by
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physical aspects of the writing task environment. For example, revision in writing on a computer can be different from that of writing on paper. Thus, some studies compared revisions in online and pen-and-paper writing process (e.g., Bridwell, Sirc and Brooke’s (1987) and Harris’ (1985) first language (L1) study). Furthermore, a few comparative studies were conducted between L1 and L2 or FL (foreign language) writing (e.g., Lindgren & Sullivan, 2006b; Stevenson, Schoonen, & de Glopper, 2006; Thorson, 2000). However, not much research has explored revision behaviors in online L2/FL writing itself, especially those of different writing proficiency levels. Thus, this study will conduct an analysis of revision behaviors of Korean EFL college students’ online writing in English.1

The study will examine the impact of L2 writing proficiency on revision behaviors of twelve students of two different levels of English writing ability, using a software program for recording keyboard activity (Inputlog) and compose-aloud protocols with retrospective interviews. It will investigate frequency of revisions in different types in terms of process types of text production (e.g., pre-linguistic, pre-contextual, or contextual); linguistic units of revision (e.g., letter, word, or phrase); purpose (e.g., surface or content changes); types of action (e.g., addition, deletion, or substitution); and remoteness (e.g., within the same sentence or across sentences).

The research questions for the study are as follows:

1. Is there a revision behavior pattern identified in Korean university students’ online writing in English in terms of text-production processes, linguistic units, purpose, action types, and remoteness of revision?
2. Do Korean university students’ revision behaviors vary depending on their English writing proficiency? Are the frequencies of revisions types different between higher- and lower-level students?
3. Is the frequency of particular types of revision specifically related to the overall quality of the writing?2

II. FRAMEWORK OF REVISION ANALYSIS

Revision is a key stage in writing process. It was viewed as editing or “tidying-up activity aimed at eliminating surface errors in grammar, punctuation, spelling, and diction”

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1 This study is an extension of Yeon Hee Choi (2006). Data from four more students was added and the compose-aloud protocols and the output file generated by Inputlog in Yeon Hee Choi (2006) were reanalyzed and recoded to examine online revisions.

2 The overall quality of the writing was measured by the holistic score of each essay using the TWE scoring rubrics with a focus on content, organization, and language use.
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This view presupposes “the three-stage linear model of composing” (Faigley & Witte, 1981, p. 400), that is, a process of prewriting, writing and rewriting. Thus, revision was viewed as changes made in a completed draft (Faigley & Witte, 1981; Hayes, 2004). This view was, however, challenged by Witte (1985) and Fitzgerald (1987). Kaufer, Hayes, and Flower (1986), and Chenoweth and Hayes (2001) illustrate that revision is often made during the composing process, not only in a completed text. As in Fitzgerald (1987), Hayes (1996), and Chenoweth and Hayes (2003), thus, revision is defined in the present study as “any change at any point in the writing process” (Fitzgerald, 1987, p. 484), that is, changes not only in an already written text but also in unwritten or partially written text. Text-level revision is sometimes distinguished from sentence-level repairs (Roca de Larios, Murphy & Manchon, 1999). The former refers to rewriting or changes beyond the current sentence, while the latter refers to changes within the current sentence or “fixing the detected problems” (Hayes, 2004, p. 13). In the present study, these two categories are all classified as revision, as in Hayes, Flower, Schriver, Stratman and Carey (1987), though they were recategorized into one of the subtypes of revision (see the data analysis section).

Hayes (1996) presented a revised version of his revision model which includes four basic writing processes, as shown in Figure 1. This model was proposed for L1 text production; however, it can be used to explain L2 text production given that the four processes are noted in the studies on L2 writing process or strategies (Yeon Hee Choi, 2006; Cumming, 1989; Zamel, 1983). The proposer generates pre-linguistic ideas or organizes content before verbalizing in the target language. In L2 writing, thus, it can operate in L1. The translator converts the generated ideas into linguistic strings in the target language. The transcriber converts the linguistic strings into written form. The last process, that is, the reviser evaluates and revises the ideas or linguistic strings proposed (by the proposer and the translator) or the written language transcribed (Chenoweth & Hayes, 2003). It operates at multiple levels: on pre-linguistic ideas, converted linguistic strings, or written language.

Hayes’ model illustrates that revision can be internal (mentally within the writer) or external (visible in the written output) (Lindgren & Sullivan, 2006a). This is a division of revision according to its location (Lindgren & Sullivan, 2006a; Stevenson et al., 2006). When changes are made on the pre-linguistic content or organization, or when the linguistic strings are not yet written, revision is internal, as revision made before transcription is called internal revision in Murray (1978). It includes pre-linguistic and pre-textual revisions (Lindgren & Sullivan, 2006a), as shown in Figure 2. On the other hand, changes on written language are external revisions. They include revisions at the point of inscription before an externalized context is “completed or ‘contextual’” (Lindgren & Sullivan, 2006b, p. 159), which is called as pre-contextual revisions (Lindgren &
pre-revision, which is referred to as contextual revisions (Lindgren & Sullivan, 2006b). In other words, external revisions are revisions made while the transcriber operates, or revisions made on the written product.

**FIGURE 1**
A Model of Text Production (Chenoweth & Hayes, 2003, p. 113)

**FIGURE 2**
Divisions of Revisions according to Types and Orientation (Lindgren & Sullivan, 2006a, p. 39)

Pre-linguistic revisions are basically conceptual changes, as shown in Figure 2, but they
also include changes in organization. Pre-textual revisions refer to changes in content and forms (such as vocabulary or grammar structures). Pre-contextual and contextual revisions include typographical changes as well as changes in content and forms. Besides processes of text production, thus, revisions are also often classified according to their orientation: conceptual, form, and typography. Formal revisions refer to surface changes (e.g., changes in spelling, grammar, capitalization, punctuation, or vocabulary), as in Faigley and Witte (1981).

Revisions are also classified according to their linguistic units: letter, word, or phrase, clause, sentence, multi-sentential, paragraph, or text (beyond paragraph level). This division is based on revision types according to discourse levels in Bridwell (1980), which was refined by Hall (1987). Moreover, revisions are classified according to their action type: addition, deletion, substitution, permutation, distribution, and consolidation. This taxonomy was designed by Faigley and Witte (1981) to analyze the impact that revisions have on the meaning of a text, that is, to differentiate revisions that change the meaning of the text and those that do not: meaning-preserving changes and meaning changes. The revision taxonomies by the length of changes and by action type are typically used to investigate revisions on written product. However, they can also be utilized in the analysis of pre-linguistic or pre-textual revisions, as in Stevenson et al. (2006).

Revisions in online writing can also be classified according to the distance of revision, as in Thorson (2000) and van Waes and Schellens (2003). It is identified by “how far the cursor moved to make the revision” (Thorson, 2000, p. 159). The distance of revision is measured by the number of lines, sentences or paragraphs between the cursor position before revision and the cursor position moved for revision.

To analyze revisions not only on the written product but also before transcription, this study adopts Lindgren and Sullivan’s (2006a) division of revisions to classify revisions on the four processes of text production in Hayes’ model (1996): pre-linguistic, pre-textual, pre-contextual and contextual. Moreover, revisions are also classified according to other taxonomies: purpose/orientation (conceptual, formal or typographical changes); linguistic units of revision (e.g., letter, word, or sentence); types of action (e.g., addition, deletion, or substitution); and remoteness (e.g., within the same sentence or across sentences) (see the data analysis section).

III. PREVIOUS STUDIES ON REVISIONS IN L1/L2 WRITING PROCESS

Revision has been investigated as a key part of writing process in both L1 and L2 (Faigley & Witte, 1981; Flower & Hayes, 1980; Hall, 1987; Sengupta, 2000; Sommers, 1980; Zamel,
1983). The majority of these studies have dealt with revising in pen-and-paper mode writing, with a focus on the effects of revision on the text of experienced and inexperienced writers. Flower and Hayes (1980) solicited verbal protocols to identify the cause of revision. They found that expert writers revised due to rhetorical constraints more often than inexperienced writers. Likewise, Sommers’ (1980) investigation of the effects of revision illustrated different revision patterns between skilled and unskilled writers according to revision length and type of operation (e.g., addition). Faigley and Witte (1981) proposed a taxonomy of revision to analyze the impact of revision on meaning: surface changes including formal and meaning-preserving changes; and text-base changes including microstructure and macrostructure changes. The comparison of changes in the writing of expert writers, and advanced and inexperienced student writers supported Sommers’ findings on different revision behaviors between different writing-level groups. Compared to the expert group, the student writers made more surface (formal) changes than text-based changes. The advanced group made changes most frequently. They made more text-based, meaning changes than the inexperienced group.

Furthermore, there are L1 writing studies that have illustrated the relationship between writing quality and revision. Bridwell’s (1980) analysis of high school students’ writing and their revision showed a close relationship of high quality writing with a wide variety of revision types. However, not all the L1 writing studies on revision have demonstrated a positive influence of revision on writing quality. Perl (1978) pointed out a negative influence of revision on the quality of less skilled college writers’ drafts. van den Bergh, Rijlaarsdam, and Breetvelt (1994) noted varied impact across revision types on writing quality: word-level changes had a negative association with writing quality, while sentence-level changes had a positive influence on it.

In L2 writing process studies in pen-and-paper mode, a discrepancy between skilled and unskilled writers was also noted. Zamel’s (1983) study on the writing process of six advanced ESL writers by observing them while composing and also doing a retrospective interview illustrated that the more skilled L2 writers revised more and revised at the discourse level like skilled L1 writers. They edited their text at the end of the whole process. In contrast, the less skilled writers revised less and adhered to accuracy of language forms, as noted in Pianko (1979) and Hall (1987). They edited from the beginning to the end, like unskilled L1 writers. Similarly, Arndt’s (1987) study on L1 and L2 writing process of post-graduate Chinese EFL writers showed differences between expert and novice writers in their degree of revising. Novice writers mostly paid attention to word-level problems. Porte (1996) also noted that the frequency of surface form changes was higher than that of content changes. But Porte pointed out that this does not mean that unskilled writers pay less attention to content than surface forms in their revisions. They didn’t give priority on text-based changes because of the impact of their past writing
experiences and perceived writing contexts. A recent study on revision in pen-and-paper mode L2 writing conducted by Yasuda (2004) also supported Porte’s finding. Yasuda explored revising processes in naturally occurring academic writing situations with a focus on individual writer behaviors. She found large variations across three ESL Japanese writers in their revising strategies and perceptions of writing behaviors due to their varied past experiences.

As computer technology advanced, word processors have commonly been used in writing classes since the 1980s. Since revision behaviors can be influenced by physical aspects of the writing environment, as pointed out by van Waes and Schellens (2003), revision in computer-medium writing has been explored. Most of the L1 writing studies comparing computer and pen-and-paper mode have illustrated that computer writers revise more (Bridwell et al., 1987; Collier, 1983), but make local changes more often than global ones (Collier, 1983; Haas, 1990) because of the computer screen size which prevents them from having a global view of their text (Haas, 1990). In contrast, a decrease of revisions in computer mode was noted in Harris (1985) and Schriner (1988).

The studies of revision in online writing have used softwares for recording keyboard activity during the production of a text using a word processor, while the studies of revision in paper-mode writing basically utilizes concurrent verbal reports (compose-aloud), retrospective self-reports or interviews. van Waes and Schellens (2003) used a program called Keytrap and found that computer writers revised more extensively at the beginning of their writing process than pen-and-paper writers, and paid more attention to lower linguistic levels (e.g., letter or word) and formal aspects of the text (e.g., layout). Likewise, a high frequency of surface-level revisions was noted in New’s (1999) analysis of French learners’ revision process using a software program called Système-D. Thorson (2000) also investigated FL writing process using the computerized tracking device J-Edit and Trace-It, and compared it with her subjects’ L1 process. The results of her analysis revealed that English-speaking learners of German revised more and made more immediate and distant changes, when composing in FL than in L1. The impact of genre was also noted: the participants tended to revise less in their letter writing in FL than in their article writing. Lindgren and Sullivan (2006b) also compared revisions in L1 and FL (EFL) writing in two text types (descriptive and argumentative) using a keystroke logging software program. Their findings illustrated more contextual revisions than pre-contextual revisions, and more formal and conceptual pre-contextual revisions in EFL writing than in L1, regardless of the text types. A higher frequency of revisions, especially language

3 Keystroke logging software programs record all the keyboard stroke presses including all insertions and deletions, non-writing (pauses) and cursor movements made by the writer, and store accurate and detailed information about time and occurrence of all of these presses and movements in a log file.
revisions (editing revisions), was also noted in FL (EFL) writing in Stevenson et al. (2006). They also found higher frequency of revisions at lower linguistic level (e.g., letter or word) in FL, as noted in van Waes and Schellens (2003), and more pre-contextual revisions and more substitution revision in FL. However, not much significant difference in higher-level revisions was noted between L1 and FL. They were not able to find a connection between revision frequencies and writing quality, unlike Bridwell’s (1980) study of pen-and-paper writers.

The majority of the studies on revision have illustrated the impact of proficiency levels (e.g., expert or student writers) and language types (e.g., L1 or FL). Regardless of the mode, writers seem to make more revisions in FL writing; regardless of language, less-skilled writers tend to make more surface changes. However, the findings of the studies are not all consistent. Porte (1999) and Stevenson et al. (2006) state that their findings do not support that less-proficient FL writers’ higher-level revisions are inhibited. Moreover, no clear evidence has been provided on the relationship of writing quality with frequency of revisions or revision types. None of the computer-aided studies on FL revisions has specifically compared EFL writers of different writing proficiency. There is no specific study on Korean EFL writers’ revision in their online writing. Thus, the present study will conduct an analysis of revision behaviors of Korean EFL college students’ online writing in English to examine the impact of L2 writing proficiency on their revision behaviors and the relationship between text quality and revisions.

IV. RESEARCH METHOD

1. Participants

Twelve Korean university students participated in the study. In order to have two groups of English writing abilities, six freshmen and six seniors were recruited. They were all female, ranging from the age of 20 to 30. All of the participants were English Education (Teaching English as a Foreign Language) majors. All of them had some experience of composing in English on computer and were relatively skillful in using MS Word, although four of the freshmen evaluated their skill level as novice. By the pretest score of English writing, which was scored by the TWE scoring criteria (maximum 6), they were divided into two groups: higher-level proficiency (HP) group (six seniors) ($M = 4.8$) and lower-level proficiency (LP) group (six freshmen) ($M = 3.1$). All of the freshmen were

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4 Four of the seniors had taken the TOEIC, and their mean score was 930.5. Another senior’s TWE score was 4.5.
studying English writing in an English composition course taught by a Korean professor who was using a process-oriented approach; two of them had studied English writing at the university for a semester with a focus on content, organization, and writing process. All of the seniors except for one student studied English composition at least for a year. Their teachers, who were native speakers of English, basically followed a process-oriented approach.

2. Writing Tasks

Three argumentative writing topics were selected from the topics of the Test of Written Examination (TWE) developed by ETS: one for the pretest and two for the main writing. The TWE topics were selected because they might be relevant and familiar to the participants. There were no word or paragraph limits set for the three topics. In order to control the impact of topics, all of the three topics were selected from one general topic field, education, which would be relevant and familiar to the participants: impact of technology on learning for pre-test; impact of classmates or parents on success of school education (topic 1), and high school students’ right to select their elective courses (topic 2), for the main writing task. In order to reduce the impact of writing topics, Topic 1 was given to half of each HP and LP group, while Topic 2, to the other half. In the pretest, participants were required to write within 30 minutes, which is the time limit administered in the TWE. But, no time limits were set for the main task because the participants were asked to type and think-aloud simultaneously.

3. Data Collection Procedure

All the participants took the pretest first within a fixed time limit (30 minutes), and then completed a questionnaire about educational background of learning English, experiences of learning EFL writing, experiences of taking the TWE, skills of using MS Word Processor, and experiences of computer-medium composing. Then they had a short training session on the compose-aloud method with a sample transcript of compose-aloud and a demonstration of compose-aloud using the keystroke logging program named Inputlog.

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5 Argumentative writing was chosen for the study because it is one of the typical types of writing instructed in college composition courses, and the participants, especially the fourth-year students, were familiar with this type of writing to prepare for the TWE for the secondary school English teacher employment test.

6 The topic difficulty was not measured.

7 This program was used in the study because it was developed for the Windows environment using MS Word or Word Perfect, while other programs such as J-Edit and Trace-it were developed for Macintosh.
and MS Word Processor. The research assistant typed a few sentences on the pretest topic while verbalizing anything that was in her mind including meta-comments, rereadings of the text or even thoughts not related to what she was writing. The main writing task was administered individually by the research assistant in the researcher’s office. For the main writing task, no time limitation was set. Most of the participants finished the task within 30 minutes to one hour. Though no interruption was made during their composing-aloud, the research assistant encouraged them to continue composing-aloud if they paused longer than 10 seconds. The whole compose-aloud process was audio-recorded and the assistant (observer) recorded notes on the participants’ key and questionable composing behaviors while observing their writing. After completing the main writing task, each subject was immediately interviewed by the observer (the assistant) of their writing process while listening to the recorded tape about details or unclear or unclassifiable parts of her composing process. The whole retrospective interview lasted about 30 minutes and the interviewer recorded notes of key information.

4. Data Analysis

The pretest writing was holistically scored by two Korean and English bilingual teachers who have experiences in teaching English writing at universities and scoring English essays. The students’ writing was scored using the TWE CBT/PBT scoring criteria (maximum 6). With the pretest scores, the participants were classified into two English writing proficiency groups, as mentioned before: higher- and lower-level group. Moreover, the output of the main writing was scored in the same way as the pretest to see the relationships between text quality and revisions. The inter-rater reliability was .925 ($p = .000$).

The compose-aloud tapes were transcribed into compose-aloud protocols. As shown (1) (in the excerpt the letter S means student and the number after it refers to that of the student), the protocols were combined with the information from the Inputlog output files (as in Figure 3): the general logging file to insert pause length and see what was typed or deleted between pauses.

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8 Despite the participants’ concerns about doing compose-aloud while writing, they all managed to accomplish the tasks without significant problems.

9 The two raters had not been specifically trained as writing raters in English; however, they taught English writing and scored their students’ essays for more than 5 years. Both of them were working on her doctoral dissertation on writing in EFL. Thus, they were assumed as reliable raters.

10 The number within the brackets < > is the length of pause (longer than 1 second) in seconds. The parentheses ( ) are used to provide keystroke information including deleting or inserting. The brackets { } are used to record observation. Underlined words or sentences refer to what is typed, while those in regular font (without any underline) are what the writer verbalizes while typing. Quotation marks indicate that the writer is reading aloud the writing prompt or previously written production.
“to know children’s school life and make it successful,” parents should know about av(now about av) <1.1> now about av about av about av (deletion of ‘v,’ substituted by ‘b’) bh (deletion of ‘h,’ substituted by ‘o’) (deletion of ‘know abou’) <4.4>

FIGURE 3
Sample Output File of Linear Text Analysis

TABLE 1
Taxonomy of Revisions

<table>
<thead>
<tr>
<th>Subcategories</th>
<th>Process types of text production</th>
<th>Purpose of revision</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>pre-linguistic, pre-textual, pre-contextual (at the point of inscription), and contextual (revision on the written text)</td>
<td>content-preserving paraphrases, content changes, vocabulary changes, grammar, punctuation, capitalization, spacing, paragraph indentation, spelling correction, and typo error correction</td>
</tr>
<tr>
<td>Types of action</td>
<td>addition, deletion, substitution, permutation, distribution (split), and consolidation (merge)</td>
<td></td>
</tr>
<tr>
<td>Linguistic units of revision</td>
<td>letter, word, phrase, clause, sentence, multi-sentential, paragraph, and whole text</td>
<td></td>
</tr>
<tr>
<td>Remoteness</td>
<td>within the same sentence, sentence before, and sentence after</td>
<td></td>
</tr>
</tbody>
</table>

Revisions were coded into different categories using the taxonomy as shown in Table 1. Spelling corrections were identified separately from typing revisions, as in Stevenson et. al. (2006). The latter referred to revisions within one second after typing; other cases
were coded as spelling changes. For example, the second and third changes in (1) were coded typing revisions. In the classification of action types, a linguistic unit which was deleted and replaced by another unit was coded as substitution rather than as deletion and addition separately;\textsuperscript{11} when it was not replaced by any form, it was coded as deletion. Permutations refer to revisions involving rearrangements (e.g., changes in the order of words, clauses or sentences). Distributions are the cases where one linguistic unit is splitted into two (e.g., one sentence into two). Consolidation is opposite to distributions: it involves merging two or more units into one (e.g., two sentences into one). The revision according to action types was coded for linguistic units both beyond letters and below words, because this study noted a high frequency of revisions by action types below words (e.g., spelling corrections), while most of the studies on revisions analyzed revisions beyond word level.

After revisions were coded, their frequencies were counted according to revision types. The frequency of each revision category per 100 words of the final text was counted to compare revisions between two proficiency groups, as in Hall (1990), New (1999) and Stevenson et al. (2006). This method was used because those who write longer would revise more. Besides, a paired $t$-test was used to compare frequency of revisions across the categories between the HP and LP group to see the impact of their writing ability.\textsuperscript{12} In order to see the relationship of writing quality with revisions, a correlation analysis was conducted between the holistic scores and revisions frequencies across revision types.

V. RESULTS AND DISCUSSION

1. Frequency of Revisions across Revision Types and Proficiency Groups

All of the subjects made revision very often; the ratio of revisions out of the total number of characters typed (R/CT) was higher in both the HP (0.10) and LP (0.11) groups than that found from the intermediate (0.06) and advanced (0.07) FL groups in Thorson (2000). Furthermore, the ratio of the total number of words written out of the total number of words typed (WW/WT) was much more higher in both the HP (79.1) and LP (70.3) groups, compared to the findings in Stevenson et al. (2006) (25.5 for HP and 28.9 for LP). As shown in Table 2, the HP group typed more and their final text was longer than the LP

\textsuperscript{11} An example of substitution is the first three changes in (1). For example, the capital letter ‘P’ was substituted by the small letter ‘p’ in the first revision.

\textsuperscript{12} The sample size was too small to run a statistical analysis, but the revision frequency was statistically analyzed to compare the findings of this study with those of other studies (e.g., Stevenson et al., 2006) which had a statistical analysis with a small sample size as the present study.
They also revised more often, as shown in the total number of revisions and the number of revisions per 100 words, though there was no statistically significant difference. This result is similar to those of Zamel’s (1983) and Hall’s (1987) study on pen-and-paper writers’ revisions, but it is different from Stevenson et al.’s (2006) finding on online revisions that lower monolingual Dutch students revised more. The HP group also made more distant revisions (revisions in sentences before or after). This finding implies that higher-level students move back and forth more in online writing or their writing is more recursive.

### TABLE 2
Quantitative Data on Online Text Production and Frequency of Revisions by L2 Writing Proficiency

<table>
<thead>
<tr>
<th>Writing Product/ Process and Revision</th>
<th>Proficiency Level</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LP</td>
</tr>
<tr>
<td>Total no of characters typed (CT)</td>
<td>1514.50</td>
</tr>
<tr>
<td>Total no of words typed (WT)</td>
<td>388.00</td>
</tr>
<tr>
<td>Total no of words written (WW)</td>
<td>236.30</td>
</tr>
<tr>
<td>WW/WT ratio</td>
<td>0.65</td>
</tr>
<tr>
<td>Holistic scores</td>
<td>3.10</td>
</tr>
<tr>
<td>Total no of revisions (R)</td>
<td>177.00</td>
</tr>
<tr>
<td>R per 100 words</td>
<td>70.30</td>
</tr>
<tr>
<td>Total no of distant revisions (DR)</td>
<td>10.50</td>
</tr>
<tr>
<td>DR per 100 words</td>
<td>3.96</td>
</tr>
<tr>
<td>R/CT ratio</td>
<td>0.11</td>
</tr>
<tr>
<td>R/WT ratio</td>
<td>0.44</td>
</tr>
<tr>
<td>R/WW ratio</td>
<td>0.70</td>
</tr>
<tr>
<td>DR/R ratio</td>
<td>0.06</td>
</tr>
</tbody>
</table>

All of the subjects made more pre-contextual and contextual revisions than pre-linguistic and pre-textual ones, that is, more external over internal revisions, as shown in Table 3. Their frequency of contextual revisions was as high as that of pre-contextual revisions, unlike Stevenson et al. (2006), which found much higher frequency of pre-contextual revisions. The LP group made more pre-linguistic and pre-textual revisions than the HP group because they struggled in generating ideas and searching appropriate lexical items, as shown in (3) (the italicized expressions are the translation of Korean). An LP student (S1) searched an appropriate word for ‘mold the character’ in Korean first (from ‘inherit’ to ‘form’) and then in English (from ‘form,’ ‘make,’ to ‘build’): the former is an example of pre-linguistic revision and the latter, that of pre-textual revision. In pre-linguistic revisions, a statistically significant difference was noted between the two groups ($t = 28.025$, $p = .000$).
TABLE 3
Frequency of Revisions per 100 Words according to Process Types of Text Production
by L2 Writing Proficiency

<table>
<thead>
<tr>
<th>Revision Types</th>
<th>Proficiency Level</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LP</td>
</tr>
<tr>
<td>Pre-linguistic</td>
<td>3.30</td>
</tr>
<tr>
<td>Pre-textual</td>
<td>4.08</td>
</tr>
<tr>
<td>Pre-contextual</td>
<td>31.49</td>
</tr>
<tr>
<td>Contextual</td>
<td>31.49</td>
</tr>
</tbody>
</table>

(3) (S1-LP) People inherit their character from their parents at the childhood? Inherit? Not ‘inherit.’ Form. (substitution of a word) Ah, people form their character. Mainly in their childhood. “People” (deletion of ‘spend their,’ substituted by ‘build their personality’; content change) <13.6> Form. If ‘form,’ …‘make.’ (substitution of a word) ‘Make’ seems strange. People built. Build, build. (substitution of a word) Form. (substitution of a word) build their personality. <18.0>

Both the HP and LP group made formal revisions more frequently than content revisions, as in New’s (1999) and Stevenson et al.’s (2006) online revisions, but contrary to a higher frequency of content revisions over formal revisions in Hall’s (1990) L2 writing on paper and van Waes and Schellens’ (2003) FL online writing (see Table 4). This may be accounted for by Haas’ statement on the impact of computer screen on online revisions (1990). The two groups often made grammar, punctuation, and spelling corrections as well as vocabulary changes. They also made high frequency of typo corrections, as noted in in New’s (1999) and Stevenson et al.’s (2006) online revisions. 13

Compared to the LP group, the HP group made more content-related revisions, especially, more content-changing revisions, as in Zamel’s (1983) pen-and-paper ESL writing and van Waes and Schellens’ (2003) online FL writing. There was a statistically significant difference between the two groups (t = 6.410, p = .03). This result suggests that more skilled EFL writers pay more attention to higher-level revisions since they have better language abilities to write more accurate language forms and better abilities to change content. The HP group made grammar corrections frequently in formal revisions, whereas the LP group changed vocabulary frequently.

13 The high frequency of typo correction noted in this study and other studies on online revisions might be accounted for by the mode of writing: computer. But, no specific data on typo corrections in paper-mode writing is available in the previous studies on revision to see whether the high frequency of typo correction is the impact of writing mode.
The Korean EFL writers made substitution revisions much more substantially than any other action types, as shown in Table 5. Addition and deletion revisions were the second and third most frequent revision. These findings are similar to those of the studies on paper-mode revisions (Hall, 1990) and on computer-mode revisions (New, 1999; Stevenson et al., 2006). The frequency of the other three revisions was very low, though their greater frequency in online revisions could be expected due to easiness in moving linguistic units using the mouse.

The HP group’s frequency was greater than the LP’s in most of the action types. A
statistically significant difference between the two groups was noted in permutation ($t = 8.364, p = .016$) and distribution revisions ($t = 5.857, p = .036$). An example of permutation revision is (4), in which a HP student moved a prepositional phrase (in terms of …) twice in a sentence using the mouse: before the subject from the end of the sentence, and then back to the end of the sentence. (In the excerpt (4), some parts of the verbal protocols combined with the recorded keyboard activity including pauses are omitted; they are marked by a series of dots.)

(4) (S8-HP) In addition. In addition, <11.6> Umm… affective aspect… peers are an important source of… in terms of affective aspect.” Umm… Move this before the subject. “In addition, peers influence children in affective aspect.” Umm… Move this before the subject. temr(deletion of ‘mr,’ substituted by ‘rm’) rms of <1.8>. (Movement of ‘in terms of affective aspect’ to the position before ‘peers’) “in terms of affective aspect peers” <6.3> have great influence after ‘peers,’ changing ‘influence’ as a noun from a verb) have a great <1.3> “influence” <1.7> on on (addition of a preposition) <5.0> “children.” “In addition… in terms…” Ah, need to move this to the end… (movement of ‘peers have a great influence on children’ before the phrase ‘in terms of’) <1.0>

The frequency of graphical changes was greater in both the HP and LP group than that of any other types, as shown in Table 6. The frequency distribution was relatively similar between the two groups; for example, lexical changes were the second most frequent category. These findings are similar to those in New’s (1999) and Stevenson et al.’s (2006) online revisions in FL writing. However, a greater frequency of phrasal and clausal revisions was noted in the HP group.

Interestingly, the lower-level students made more changes in text level than the higher-level students; a statistically significant difference was found ($t = 6.245, p = .031$). This is due to their pre-linguistic changes of the content of the whole text, as shown in (5). A lower-level student decided to write against the given statement first and then agree with it after she had some thought on the topic. Most of the LP students spent more time on planning, compared to the HP students, as reported in Yeon Hee Choi (2006).
TABLE 6

Frequency of Revisions per 100 Words according to Linguistic Units by L2 Writing Proficiency

<table>
<thead>
<tr>
<th>Revision Types</th>
<th>Proficiency Level</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LP</td>
</tr>
<tr>
<td>Graphical changes</td>
<td>43.64</td>
</tr>
<tr>
<td>Lexical changes</td>
<td>18.12</td>
</tr>
<tr>
<td>Phrasal changes</td>
<td>5.55</td>
</tr>
<tr>
<td>Clausal changes</td>
<td>1.43</td>
</tr>
<tr>
<td>Sentence changes</td>
<td>1.28</td>
</tr>
<tr>
<td>Multi-sentential changes</td>
<td>0.21</td>
</tr>
<tr>
<td>Paragraph changes</td>
<td>0.00</td>
</tr>
<tr>
<td>Text changes</td>
<td>0.21</td>
</tr>
</tbody>
</table>

(5) (S4-LP) ... *It asks me whether I agree or disagree.* “Classmates are a more important influence than parents on a child's success in school.” Classmates *have a more* important influence *than* parents, on a child's success in school. *On academic achievement.* *Does ‘child’ mean an elementary school student?* … *Well, since I have to think whether I will agree or disagree. As for children, parents’ influence is greater? Then, I disagree that classmates have a more important influence and write that parents affect… what kind of influence. According to the theory of child development, the children at the concrete operational stage… Wait a minute… Have more influence from their friends… *Then, I have to change. I have to agree… Since I’m writing my opinion. I believe that I believe that classmates have more influence, classmates have more influence* <1.0> classmates have more influence <1.8>

The frequency of distant revisions was much smaller than that of revisions within the sentence (see Table 7), which is different from the finding of van Waes and Schellens (2003): much higher frequency of distant revisions in their FL online writing. A possible account for this discrepancy is the differences in coding methods. This study used sentence boundaries to identify distant revisions, while van Waes and Schellens coded them according to the number of lines above or below the point of inscription. Compared to the lower-level students, the higher-level students made more distant revisions. But the differences were not very large; no statistically significant difference was noted.
**TABLE 7**

Frequency of Revisions per 100 Words according to Remoteness by L2 Writing Proficiency

<table>
<thead>
<tr>
<th>Revision Types</th>
<th>Proficiency Level</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LP</td>
</tr>
<tr>
<td>Within the same sentence</td>
<td>66.45</td>
</tr>
<tr>
<td>Sentences before</td>
<td>1.98</td>
</tr>
<tr>
<td>Sentences after</td>
<td>1.94</td>
</tr>
<tr>
<td>1 sentences before or after</td>
<td>2.21</td>
</tr>
<tr>
<td>2-4 sentences before or after</td>
<td>1.09</td>
</tr>
<tr>
<td>5-7 sentences before or after</td>
<td>0.43</td>
</tr>
<tr>
<td>More than 8 sentences before or after</td>
<td>0.08</td>
</tr>
</tbody>
</table>

2. Relationship of Text Quality with Revisions

A significant correlation was noted between the holistic score and the length of the final text for all of the subjects ($r = .600$, $p = .039$), as in Stevenson et al. (2006). A correlation analysis of the holistic score of the text with revision frequencies across the categories was conducted to see whether the frequency of particular types of revision is specifically related to the overall quality of writing. No significant correlation was noted for the entire subjects, as in Stevenson et al. (2006). However, there were positive correlations of writing quality with the following types of revision: total frequency of revision ($r = .364$); revisions per 100 words ($r = .105$); distant revisions ($r = .157$); pre-contextual revisions ($r = .142$); contextual revisions ($r = .143$); content changes ($r = .196$); grammar corrections ($r = .512$); phrasal changes ($r = .299$); clausal changes ($r = .249$); and revisions in sentence after ($r = .237$). On the other hand, negative correlations of text quality were noted with pre-linguistic revisions ($r = -.495$); pre-textual revisions ($r = -.115$); vocabulary changes ($r = -.309$); capitalization corrections ($r = .308$); word changes ($r = -.308$); and text changes ($r = -.158$). These results are related to different distribution of the frequency of revisions between the HP and LP group. The revision types frequently identified in the HP had generally positive relationships with text quality. This implies that those who revise more make their text better, especially when they revise while or after typing, and when they make higher-level revisions (e.g., content changes and clausal changes). A positive relationship of text quality with changes of larger units such as parts of sentence rather than below words was also noted in van den Bergh et al. (1994). Berg’s (1999) study on the effect of peer response training on writing quality and revision types also illustrated a relationship between revision types and writing quality, that is, that of the frequency of

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14 The correlations of writing quality with the frequencies of revision types were not high enough to draw valid insights into their relationship, besides the fact that the sample size was too small to do a valid statistical analysis, as mentioned before. But correlations were measured to compare the results of the study with those of Stevenson et al. (2006).
meaning revisions with text quality.

In the LP group, only one significant negative correlation was found between their holistic score and the frequency of language revisions ($r = -.874, p = .023$), which illustrates that less skilled students who made more formal revisions because of their language problems obtained lower scores. In the HP group, interestingly, only one significant positive correlation of their text quality was noted with spelling corrections. The text quality of higher-level students had a negative correlation with total frequency of revision ($r = -.132$); revisions per 100 words ($r = -.244$); pre-contextual ($r = -.285$) and contextual ($r = -.360$) revisions, content changes ($r = -.441$); typo corrections ($r = -.239$); and graphical ($r = -.080$), lexical ($r = -.398$) and phrasal ($r = -.400$) changes, which is opposite to the findings from the total subjects. This implies that more skilled HP students revised less like L1 expert writers in Faigley and Witte (1981) because they did not have many problems in generating ideas and expressing their ideas so that they did not have to revise as much as less skilled students.

Another correlation analysis of revisions across process types was conducted with those across purposes, action types, and linguistic units to see what kind of revisions were made across process types of text production. As expected, a significant correlation of pre-contextual revisions was found in the total subjects with typo correction ($r = .972, p = .000$); substitution ($r = .875, p = .000$); and graphical changes ($r = .966, p = .000$). Moreover, that of contextual revisions was noted with content revisions ($r = .903, p = .000$); addition ($r = .867, p = .000$); deletion ($r = .756, p = .004$); and word ($r = .634, p = .027$) and phrasal ($r = .840, p = .001$) changes. Similar results of the correlation analysis were also found in the HP and LP group. These imply that at the point of inscription the subjects often corrected typos by substituting wrong letters with correct letters, which was also found in Stevenson et al. (2006); and they changed content frequently by adding and deleting words or phrases after finishing typing the target unit.

VI. CONCLUSION

Revision behaviors in Korean university students’ online writing in English were analyzed to find the answer for Research Question 1, whether there is any revision behavior pattern in terms of text-production processes, linguistic units, purpose, action types, and remoteness of revision. The Korean EFL college students of the study revised very frequently, especially externally rather than internally (e.g., more pre-contextual or contextual revisions than pre-linguistic or pre-textual revisions). They made more formal revisions than content revisions, as reported in New’s (1999) and Stevenson et al.’s (2006) online revisions. The frequency of substitution revisions was greater than any other action
types, while addition and deletion revisions were the second and third frequent type. The Korean students made graphical changes (e.g., punctuation, spelling or typo corrections) most frequently, while lexical changes were the second most frequent category. They did not make distant revisions as frequently as revisions within the same sentence. A correlation analysis of frequencies of revisions across their types illustrated a revision pattern: at the point of inscription the subjects often corrected typos by substituting wrong letters with correct letters (editing revisions), while they changed content frequently by adding and deleting words or phrases after finishing typing the target unit.

In order to see whether Korean university students’ revision behaviors vary with their English writing proficiency (Research Question 2), the frequency distribution of revisions across different types were compared between higher- and lower-level students. Some variations in their revision behaviors were noted. The HP group revised more and wrote longer, as in other studies (Hall, 1987; Zamel, 1983). They did not revise before typing as frequently as the LP students. They made more high-level revisions (content-related revisions, and phrasal and clausal revisions) and more distant revisions. Their frequency of revisions in terms of action types was greater than that of the LP group; a statistically significant difference was noted in permutation and distribution revisions though their total frequency was not large. On the other hand, lower proficient students made more pre-linguistic (such as the whole text-level revision to change the direction of their writing) and pre-textual revisions. These findings suggest that they revised more while planning, as noted in Yeon Hee Choi (2006), since they struggle in generating ideas and searching appropriate lexical items. The high frequency of vocabulary changes in the LP group also illustrates their trouble in finding appropriate lexical items.

The correlation analysis of the holistic score of writing did not reveal any significant correlation with the frequency of revisions across types (Research Question 3), while a statistically significant positive correlation was noted between text quality and text length. This result appears to support Stevenson et al.’s (2006) finding that “poorer text quality did not manifest itself in higher frequencies of lower level revisions” (p. 224). But, positive correlations of text quality with the total frequency of revision, revisions per 100 words, distant revisions, content changes, and phrasal and clausal changes, and its negative correlations with vocabulary and capitalization corrections, and word changes suggest that the EFL writers who revise more, especially when they make higher-level revisions (e.g., content changes and clausal changes), make their text better. Furthermore, this tentative conclusion is supported by a significant negative correlation found between text quality of less proficient students and their frequency of language revisions. Interestingly, the text quality of higher-level students had a negative correlation with revision types which showed a positive correlation in the total group. This implies that more skilled writers within the higher-level group revise less like L1 expert writers because their writing is
relatively fluent without much trouble in generating ideas and searching appropriate lexical items, as stated in Stevenson et al. (2006, p. 224): “Writers with more problems in their texts probably revise more, while writers who are initially able to produce a better text less need to revise (Rijlaarsdam, Couzijn, & van den Bergh, 2004).”

The results of this preliminary study shed light on Korean EFL writers’ online revisions, the impact of writing proficiency on them, and their relationship with text quality, though no one clear picture has been provided for each issue. However, the sample size is not large enough to make a valid generalization, which suggests more research with larger population to verify the results of the study. Computer-medium writing increases these days and computer writers use a variety of resources including Internet information. This study did not examine use of Internet resources in online writing process. Thus, future studies in natural settings need to be done to explore in what ways computer writers use a variety of resources for their revisions in their online writing. Furthermore, the impact of cognitive load or genre types needs to be investigated. As Thorson (2000) and Lindgren and Sullivan (2006b) compared online revisions in different text types, revisions may vary with genre types. Revision behaviors might be influenced by cognitive load of writing tasks or topics, as the inhibition hypothesis was proposed that if attention is given onto formal or linguistic revisions, higher-level revisions are inhibited since attention to them is detracted (Stevenson et al., 2006).

As in Stevenson et al. (2006), this study cannot provide a clear answer as to whether revisions actually improve the quality of the text. However, the findings from the correlation analysis manifest meaningful impact of higher or global level revisions on writing quality. Thus, a future study on online revisions with revision training is suggested to explore whether higher-level revisions can increase after training. For such a study, a systematic design of training methods would be essential. As the results of the study demonstrated, generation of content or ideas is difficult for less proficient students. They also have problems in translating their ideas into the target language. Thus, revision training needs to include a way to help less skilled writers not only to find information on the writing topic but also to express or translate their ideas in L2/FL, using a variety of computer-mediated resources, besides the ability to note a gap between intended meaning and how it is expressed in the target language, as pointed out in Berg (1999).

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Yeon Hee Choi
Dept. of English Education
Ewha Womans University
11-1 Daehyun-dong, Seodaemun-ku
Seoul, 120-750, Korea
Tel: (02) 3277-2655
Email: yhchoi@ewha.ac.kr

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