

Time Factors in EFL Writing Complexity, Accuracy, and Fluency: A Preliminary Trade-off Model

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Abstract

The Limited Attentional Capacity Model (LACM) is believed to influence the memory processing system, causing a trade-off relationship between the levels of complexity, accuracy, and fluency (CAF) in writing by EFL students. Among the factors that influence EFL student writers' use of the LACM and their ability to maintain a balanced, shifting relationship between the three linguistic features, time may be considered one of the most influential variables. However, the current literature on the exclusive influence of time on EFL college students' CAF in writing is relatively limited. This study aims to manipulate time as a variable in undergraduate EFL students' writing to shed light on the dynamic interaction between the elements of CAF as used by these students. The research results indicate a clear trade-off model triggered by time factors between fluency and complexity/accuracy. Specifically, when writing under great pressure (i.e., a limited time frame of 20 minutes), the participants tended to develop writing fluency over complexity and accuracy. In contrast, students' writing complexity and accuracy were developed at the expense of fluency when they were given more time (40 minutes). The paper concludes by discussing possible reasons for the trade-off mode identified in the results and by identifying avenues for further investigation.

Key words: The Limited Attentional Capacity Model, EFL writing, time factors

INTRODUCTION

Complexity, accuracy and fluency (CAF) have long been considered three essential linguistic features in the field of language learning (Housen & Kuiken, 2009). For the past two decades, many researchers have dedicated themselves to investigating factors and conditions that may affect students' performance in either oral or written CAF (e.g., Kuiken & Vedder, 2007; Ong & Zhang, 2010, 2013; Robinson, 2011; Skehan & Foster, 2001; Tavakoli & Foster, 2011; Yuan & Ellis, 2003). Some scholars have recognised CAF as an effective indicator of language students' learning (Ellis, 2003; Ellis & Barkhuizen, 2005; Norris & Ortega, 2009; Skehan, 1998; Housen, Kuiken, & Vedder, 2012). Many researchers have assessed students' language performance using CAF as three separate units and as a whole (Housen, Kuiken, & Vedder, 2012; Lu, 2011; Wolfe-Quintero, Inagaki, & Kim, 1998), whereas others have attempted to identify methods to help students develop these three linguistic skills (e.g., Hunter, 2012).

In longitudinal observations, researchers have found in the co-existence of CAF an interesting relationship—the “trade-off model,” also known as the Limited Attentional Capacity Model (LACM) (Skehan, 1998, 2009; Skehan & Foster, 1999, 2001). It has been hypothesised that when learners of limited language proficiency must work on tasks of different degrees of difficulty, they tend to focus on one linguistic dimension at the cost of others (Ellis & Yuan, 2004; Skehan, 2009; Skehan & Foster, 2001). For example, when students are forced to concentrate on accuracy, their complexity and fluency may be underdeveloped (Ellis & Yuan, 2004).

To shed light on the dynamic interactions among CAF, researchers have empirically manipulated different variables in their studies. Among these variables, the complexity of writing tasks and the use of pre-task planning have commonly been investigated (Ellis & Yuan, 2004; Johnson, Mercado, & Acevedo, 2012; Ong & Zhang, 2010, 2013; Salimi &

Dadaspour, 2012; Salimi, Dadaspour, & Asadollahfam, 2011). Some researchers have proposed that because students are unable to balance all three linguistic dimensions, a trade-off model may force accuracy to compete with complexity and fluency (Ellis & Yuan, 2004), other researchers have observed that fluency is developed at the cost of accuracy and/or complexity (Wendel, 1997; Skehan & Foster, 2001), and still others have observed that sufficient pre-task planning can increase the complexity of students' writing, which leads to improved fluency (e.g., Ong & Zhang, 2010). It has also been reported that when EFL/ESL students are given writing tasks but no time for pre-task planning or preparation, CAF performance diminishes noticeably (Ellis & Yuan, 2004).

In addition to the complexity of tasks and the use of pre-task planning, other factors may trigger interactions between the elements of CAF, such as students' learning preferences and motivations, abilities to cope with anxiety/pressure, or linguistic proficiency levels (Housen, Kuiken, & Vedder, 2012). Of all the possible determinants, time may be one of the most important factors that cause the individual elements of CAF to compete with each other, in keeping with the LACM (cf. Yuan & Ellis, 2003). It has been suggested that more complex writing tasks tend to require more time for the brain to process existing language capabilities in order to create and structure corresponding linguistic output (Ellis & Yuan, 2004; Ong & Zhang, 2010). In other words, when given insufficient time, students may be forced to make quick linguistic decisions when presenting their ideas, thereby sacrificing certain accuracy in language use.

Although time is influential in students' linguistic performance, little research has focused exclusively on time as an independent variable in the trade-off between the elements of CAF (Yeh & Lin, 2015). Most researchers who include time as a variable in their studies in this field link it to pre-task planning (e.g., Li, Chen, & Sun, 2014; Ong & Zhang, 2010), but the dynamic interaction between CAF triggered by time resources alone has not been adequately explored,

particularly in the context of Taiwan. This study aims to investigate the potentially shifting CAF interactions in Taiwanese EFL students' writing samples that are created at different levels of time pressure. The research question is: *Do time factors trigger the trade-off model in the CAF of Taiwanese EFL students' writing samples?*

To answer this question thoroughly, it is necessary to first establish whether there are any differences in the CAF of EFL students who write under different degrees of time pressure. The correlations between the three dimensions from student to student also require investigation. Furthermore, it is crucial to observe how the three linguistic features interact with each other in writings produced under different time conditions.

Definitions and Measures of CAF Units

Accuracy is perhaps the most studied aspect among the three elements of CAF, and its assessment is likely to be the easiest and least arguable. Accuracy is generally measured by its absence—the lack of any nonstandard or erroneous linguistic features that break commonly agreed-upon linguistic rules (Wolfe-Quintero, Inagaki, & Kim, 1998). That is, free linguistic error rates are used to reflect the accuracy of the assessed text (e.g., Ellis & Yuan, 2004; Fazio, 2001; Polio, 1997). Accuracy measures that are commonly used include error-free clauses, general grammatical errors, error-free T-units¹ (EFT), and other types of errors.

Fluency commonly refers to general language proficiency, particularly the flow of linguistic output (Housen & Kuiken, 2009; Hilton, 2008). This characteristic is usually assessed in a given time frame (e.g., Ellis & Yuan, 2004; Fellner & Apple, 2006; Li, Chen, & Sun, 2014; Latif, 2013), such as words or syllables per minute (Chenoweth & Hayes, 2001).

¹ The notion of T-units will be addressed in Methods.

Complexity is likely to be the most difficult and complicated feature of CAF to define and assess. This is because at least two aspects are involved in portraying its characteristics: the number of linguistic units used and the diversity of the sentence structures (cf. Housen, Van Daele, & Pierrard, 2005; Williams & Evans, 1998; Wolfe-Quintero, Inagaki, & Kim, 1998). Degrees of complexity are frequently measured by calculating various aspects of T-units, such as the number and range of clauses and/or participles per T-unit (Ellis & Yuan, 2004; Hunt, 1965; Wolfe-Quintero, Inagaki, & Kim, 1998), the total number of T-units divided by the number of sentences (Hunt, 1965; Ishikawa, 1995; Monroe, 1975), or simply words per T-unit (Hunt, 1965). The tendency to count T-units may be due to the fact that they require the use of different types of clauses, but they have also been found to positively correlate with linguistic performance (cf. Hunt, 1965; Wolfe-Quintero, Inagaki, & Kim, 1998). The density of T-units in a language measured against other linguistic patterns/forms is thus believed to reflect linguistic complexity.

METHODS

Participants

This study was conducted at a private university in northern Taiwan. Two intact writing classes of 42 EFL students in total agreed to participate in the project after signing consent forms. The student writers were mostly between the ages of 19 and 20, and the gender ratio was 14 male students to 28 females. Before participating in this experiment, the participants had studied English for an average of 7 to 11 years, and their English proficiency ranged from level A2 to B1 on the Common European Framework of Reference (CEFR). Only a small number of the students were at the advanced B2 level. The students were randomly assigned into one of two groups (21 students each).

Timed Writing Tests

Both groups were given the same test instruction. They were limited to writing the same genre, a descriptive paragraph. They had to write at least 120 words, and each student also had to choose for him or herself a topic that s/he wished to describe the most, be it a person, an event, or an object. To examine how time resources might affect the CAF trade-off relationships in their writing samples, one group was assigned only 20 minutes to complete the task, whereas the other group was given a sufficient time frame of 40 minutes. The word limit and time lengths used in this project were determined based on the design of the writing section of a popular national (Taiwan) English test called the General English Proficiency Test (GEPT). The GEPT has been in use for more than 15 years, and its writing section at the intermediate level (approximately CEFR level B1) contains two parts: Chinese-to-English translation (5 complete sentences) and English composition (at least 120 words). The two parts are to be completed within 40 minutes. Given the omission of the translation task, 40 minutes was expected to provide student writers reasonable, if not sufficient, time resources to complete the writing task, whereas 20 minutes could have been insufficient, leading to relatively greater time pressure.

The writing tests were administered in a computer lab where the participants were required to compose their writing using *Notepad*, which was pre-installed on the computers. Notepad provides only basic word processing functionality, which prevents users from accessing more advanced resources such as spelling checks, grammar correction, or a thesaurus. The time of the final document save, which was automatically recorded for each student's writing file, was used to calculate the exact amount of time each student spent on the task.

Raters and CAF Measures

Two English writing teachers (i.e., the two researchers of this study) separately assessed the students' writing samples. Before the assessment, the raters had agreed on the

characteristics of T-units and measurement criteria for each element of CAF. To be specific, both raters agreed that a T-unit comprising more words was more complex than one that contained fewer words (cf. Hunt, 1965). The raters further agreed to count an independent clause as a T-unit, and all the dependent clauses, phrases, or appositives that were attached to it were counted as part of the T-unit (Hunt, *ibid.*). Additionally, clauses connected using coordinating conjunctions were counted as distinct T-units (*ibid.*)². On this basis, the raters proceeded to the following CAF measures:

- a. accuracy was measured with the EFT ratio (EFT/T) (i.e., the total number of EFT divided by total number of T-units) (cf. Evans, Hartshorn, Cox, & Martin de Jel, 2014);
- b. fluency was assessed by calculating the total number of words per minute (W/M) (Ellis & Yuan 2004; Ishikawa, 1995; Latif, 2013);
- c. complexity was measured as the sentence coordination ratio (T/S) (i.e. total number of T-units divided by total number of sentences) (cf. Ishikawa, 1995; Kawata, 1992; Lu, 2010).

The results of two inter-rater reliability tests via Pearson's r showed strong agreement between the two raters in terms of the accuracy ($r = .80$ at $p = .000$) and complexity assessments ($r = .94$, $p = .000$). This finding indicates that the raters' scores were valid for data analysis. The averages of the raters' scores were then computed for the data analysis. No inter-rater reliability test was conducted for the fluency assessments because of the way it was measured: the total

² For further discussion about how T-units have been put into practice, please refer to Housen, Kuiken, and Vedder (2012), Hunt (1965) or Wolfe-Quintero, Inagaki, and Kim (1998).

number of words was automatically calculated by computer using WordSmith 5.0, and the time used for each writing sample was also automatically recorded. Basic division generated the final result.

Data Analysis

To observe whether time as a factor led to any differences between the CAF of the 20-minute writing group's samples (20 MG) versus those of the 40-minute group (40 MG), inferential statistics using a set of independent-sample *t*-tests were first performed. In addition, Pearson's *r* was calculated once more to observe any relationships between CAF. Finally, the researchers planned to use descriptive statistics with charts to portray the differences in CAF between groups as well as the way the elements of CAF might have interacted with each other in the students' writing samples.

RESULTS

Differences between the two groups' writing samples

The raw data on both groups' writing samples are shown in Table 1. It appears that with greater time resources, the students in the 40 MG were able to create articles with richer descriptions and expressions and more ideas; more words, sentences, and T-units were found in the writings from that group. Although more errors also appeared in the lengthier compositions produced by the 40 MG, the ratio of errors to words suggested otherwise. On average, the 20 MG created an error every 9.64 words, whereas the 40 MG made an error every 9.93 words. Although EFT per article is higher in the 20 MG, which suggests that the students in that group wrote slightly more accurately than did the 40 MG, an initial conclusion drawn on these descriptive data indicates that time resources helped the 40 MG students to write better than those in the 20 MG.

Although the basic data above suggest that the 40 MG students wrote more skilfully, the independent-sample *t*-tests revealed a contradictory tendency. As Table 2 shows, the 20 MG students produced articles with greater complexity and accuracy than did the other group, although there were no significant differences between them ($t < 1.96$, $p > .05$) (see Table 2). A starker phenomenon is that when fluency was measured by words per minute, the 20 MG students outperformed the other group at a statistically significant level ($t = 3.56$, $p < .01$). This finding may imply that when time is insufficient, student writers may tend to focus more on their fluency. An additional implication of the combined results is that the 20 MG had greater writing skills in terms of CAF as a whole than did the 40 MG.

Table 1
Basic data on the two groups' writing performance

| Items | 20 MG | 40 MG | Differences |
|-----------------------|--------|--------|-------------|
| Minutes per article | 21.48 | 38.78 | -17.3 |
| Words per article | 184.05 | 231.67 | -47.62 |
| Sentences per article | 13.29 | 14.57 | -1.28 |
| Errors per article | 19.10 | 23.33 | -4.23 |
| T-units per article | 15.67 | 17.24 | -1.57 |
| EFT per article | 5.43 | 4.95 | 0.48 |

Table 2

Independent-sample CAF *t*-test results for the two groups

| Items | Group | N | Mean | SD | <i>df</i> | <i>t</i> | <i>p</i> |
|------------|-------|----|------|------|-----------|----------|----------|
| Complexity | 20 MG | 21 | .49 | .32 | 40 | .41 | .681 |
| | 40 MG | 21 | .44 | .36 | | | |
| Accuracy | 20 MG | 21 | .80 | .16 | 40 | 1.20 | .238 |
| | 40 MG | 21 | .75 | .13 | | | |
| Fluency | 20 MG | 21 | 8.90 | 3.18 | 40 | 3.56 | .001 |
| | 40 MG | 21 | 6.00 | 1.94 | | | |

Interaction between CAF

Although additional time resources did not appear to contribute to the CAF of the students' writings, Tables 3 and 4 show an effect of time on the interaction between the individual CAF elements. Whereas Table 3 reveals no obvious correlation between the three writing dimensions in the 20 MG's writing samples, Table 4 shows an apparent relationship between complexity and accuracy in the 40 MG's writings (Pearson's $r = .599$ at $p < .001$). This finding suggests that students tended to focus on different aspects when they wrote under different levels of time pressure.

Additionally, it is interesting that although they were not statistically significant, the correlations between accuracy and fluency and complexity and fluency in the 20 MG were all *positive*, whereas all correlations in the 40 MG were *negative*. This consistent trend may suggest that when students were allowed more time, the 40 MG tended to develop their complexity and accuracy at the expense of fluency.

Table 3
Pearson's *r* values for CAF interactions in the 20 MG

| | Complexity | Accuracy | Fluency |
|------------|------------|----------|---------|
| Complexity | 1 | .365 | .345 |
| Accuracy | .365 | 1 | .245 |
| Fluency | .345 | .345 | 1 |

Table 4
Pearson's *r* values for CAF interactions in the 40 MG

| | Complexity | Accuracy | Fluency |
|------------|------------|----------|---------|
| Complexity | 1 | .599** | -.355 |
| Accuracy | .599** | 1 | -.238 |
| Fluency | -.355 | -.238 | 1 |

** Correlation is significant at the 0.01 level (2-tailed).

The following two comparative figures (Figures 1 and 2) provide supplementary evidence for the above conjunctures that student writers tend to focus on fluency when given less time but tend to focus on complexity and accuracy over fluency when assigned more time. Prior to interpretation, it should be noted that in the figures, the researchers equally proportioned the ratio of fluency measures alone (words per minute) to 10 per cent of their original figures. This allowed the fluency curve to be presented next to the curves for complexity and accuracy for a proportional, meaningful comparison. Additionally, all the curves are presented following the fluency levels, from the lowest on the left to the highest on the right. In the following results, the researchers used pseudonyms to discuss the students' performance in the 20 MG (Student a through Student u) and the 40 MG (Students A through U).

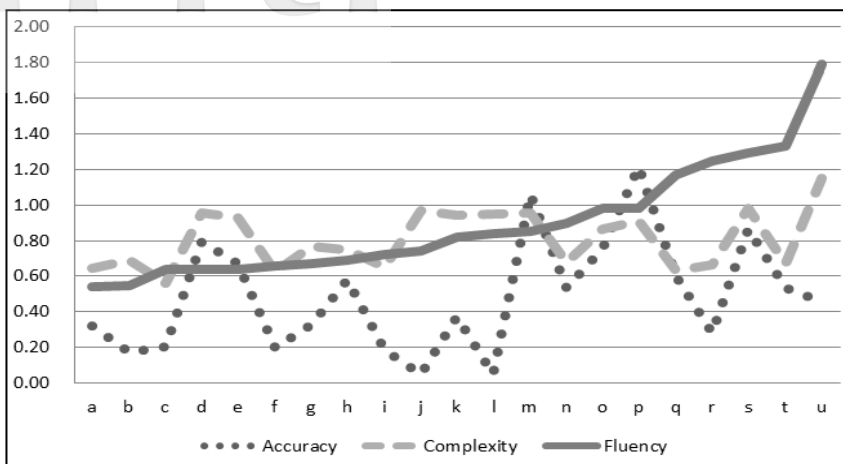


Figure 1. The CAF interactions in the 20 MG

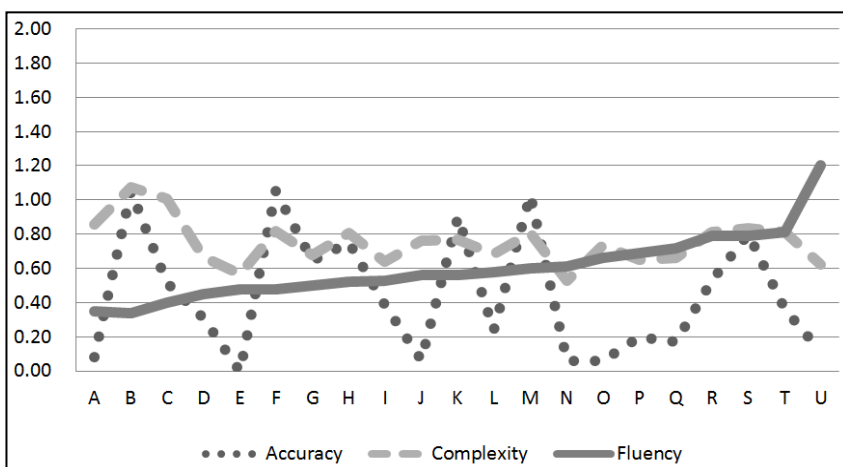


Figure 2. The CAF interactions in the 40 MG

It is clear that the fluency curve in the 20 MG rose more rapidly than it did in the 40 MG. Considering this finding along with the fact that most parts of the accuracy and

complexity curves fell *below* the fluency curve in the 20 MG but *above* the fluency curve in the 40 MG, it is reasonable to argue that the 40 MG students might have developed their accuracy and complexity skills at the cost of fluency.

Another noticeable phenomenon can be observed at both ends of the curves. The least fluent student writer's (Student a) fluency level was similar to—and between—that same student's accuracy and complexity levels. Additionally, all of Student a's CAF levels were either the lowest or near the lowest. In contrast, in the 40 MG group, the least fluent writer's fluency level was well below her accuracy and complexity levels, which were both the best in her group. This sharp contrast between the individual elements of CAF was nearly identical at the other end of the curve in the 40 MG. The phenomena at both ends of the figures supplement the evidence for the effect of the trade-off model, that is, fluency versus complexity and accuracy.

In the trade-off relationship found thus far, the pattern of accuracy appears to correlate most drastically and unstably with the other two dimensions in both groups. As seen in Figures 1 and 2, although the fluency curves consistently rise from the left to the right and the complexity curves remain relatively even, the accuracy curves fluctuate much more drastically in both groups. This effect is even more noticeable in the 40 MG. It is difficult to interpret exactly which aspect was affected by the different levels of time pressure, but an initial interpretation is possible: time appeared to have a greater impact on accuracy than on complexity. In other words, it may not be far from reality to state that student writers tend to struggle with accuracy when allowed different amounts of time, leading to greater conflict between accuracy and fluency.

DISCUSSION AND CONCLUSION

The present study examined the effects of different levels of time pressure on EFL student writers' performance. Specifically, the aim was to determine whether the trade-off model applied to the CAF of the students' writings and how the three separate elements interacted with each other when the writings were produced in different amounts of time. The researchers found mixed results.

First, the research results confirmed the conjecture that time affects EFL student writers' CAF. Surprisingly, however, not only did the two groups have similar proficiency levels in writing complexity and accuracy, but the participants who wrote under greater time pressure (20 minutes) also had a significantly better command of fluency skills than did those who composed with more time (40 minutes). This finding contradicts those of Ellis and Yuan (2004) and Ong and Zhang (2010). When students had more time for pre-task planning and for actual writing, Ellis and Yuan observed greater improvements in both fluency and complexity than was found among the students with limited resources. Ong and Zhang also found that their students demonstrated greater writing fluency. One of the reasons for the difference between this study's findings and those of Ong and Zhang may stem from the use of different writing genres. Whereas a descriptive writing test was administered in this study, a somewhat different writing task, an argumentative essay, was used in Ong and Zhang's study. In addition, the different results between the current investigation and the studies of Ong and Zhang and Ellis and Yuan may have been due to the students' use of pre-task planning strategies. Whereas Ellis and Yuan and Ong and Zhang employed a blend of different pre-task planning skills and different lengths of time, the current study had one exclusive focus: the effects of time differences. To some extent, the results of the current study may provide a relatively stronger base for shedding light on the effects of time on students' writing, particularly their fluency. Furthermore, this difference among studies may justify the

importance of observing the influence of time factors alone on student writers' performance.

It is also important to discuss possible reasons why the 20 MG students were able to write more fluently than the 40 MG students. One of the possibilities is that when the 40 MG students had reached a satisfactory article length (as well as a satisfactory number of ideas), they might have spent their extra time reviewing, rewriting, and even restructuring their writing rather than continuing to write for the entire time or continuously generating new ideas. Their failure to extend their articles in terms of length and ideas could easily have caused them to appear less fluent in writing when that linguistic feature was measured by words per minute. This reasoning raises a question: what time frames or word limits could serve as more valid independent variables for observing students' writing performance? A more crucial question is whether time frames can fairly reflect the true nature of fluency. This could be a line of inquiry for future investigators to pursue.

If the above reasoning is accurate, another question that requires consideration is the possible reason that the extra time the 40 MG spent on revision (as assumed by the researchers of this study) failed to improve their accuracy or complexity to greater levels than those of the other group. Unfortunately, the participants' writing proficiency levels were likely the cause. The participants were relatively new writers in their first-year college studies, and most of their English abilities spanned CEFR levels A2 and B1. Thus, it is unsurprising that they might have failed to adopt advanced linguistic patterns or use more correct forms. One phenomenon the raters observed was that the students' limited English abilities prevented them from successfully presenting the advanced, complicated language structures that they had intended to create. This led not only to decreased complexity levels but also to more errors.

This discussion confirms another major finding of this study: time factors did indeed trigger the Limited Attentional Capacity Model with regard to CAF—specifically, fluency versus complexity and, more likely, accuracy. On the one hand, this finding corresponds to Skehan and Foster's (2001) argument about students' oral linguistic performance, in which a trade-off effect was detected between linguistic form (i.e., accuracy) and fluency. On the other hand, the results of this study resemble aspects of Ellis and Yuan's (2004) observations of writing CAF: accuracy outweighed fluency and complexity. To some extent, this study's findings also echo those of Kenworthy (2006), in which more linguistically accurate essays were produced when student writers were allowed sufficient time to write at home than during timed classroom writing activities. However, given that all these experiments, including the current one, were conducted under different conditions, future investigations on the exact nature of the trade-off relationships between the CAF elements are necessary. In particular, it would be helpful to repeat the experiment by comparing more groups and participants under conditions that combine variations on time and pre-task planning versus conditions that focus exclusively on different time lengths.

The research focus and methodology in this study also present other opportunities for further research. First, because the students' limited English proficiency might have been a crucial factor in their CAF performance and their writing in this study, future investigators may provide helpful insight by examining advanced student writers' CAF performance. In a similar vein, a comparison between students at different writing proficiency levels may shed light on the CAF trade-off model, contributing knowledge to this field and enabling writing teachers to provide more precise assistance to different EFL students. In addition, student writers' personalities may have led them to focus on different aspects of CAF. Moreover, in this study, the researchers were only concerned with the influence of time on a descriptive writing task; thus, the interactions of these variables under different

time conditions in other genres, such as formal or academic essays, remain unknown. Last but not least, while the 20 MG apparently needed slightly more time than the amount they were given, the 40 MG showed no interest in taking advantage of the extra time they had left when their writing was finished. Investigation into different time frames may lead students to create different textual output, which would shed more light on this line of inquiry.

Finally, that the study in its current form had some intrinsic limitations also opens up opportunities for future investigation. First of all, although the current literature on the exclusive influence of time on EFL college students' CAF in writing is relatively limited, and in this sense the research results reported in this paper indeed offer a new contribution to this line of research, how the student writers in this study spent their time on the complicated writing process, such as restructuring, rewording, reviewing and revising, however, has not been monitored. Perhaps videotaping students' writing process would shed greater light on this aspect and allow relatively in-depth analysis of time factors on students' writing CAF. Second, in this study the students were freely allowed to spend the given time the way they wished, and therefore it is no surprise that whereas some would start writing instantly, some others might choose to brainstorm, plan, and rehearse before they wrote. How learners play with their time, therefore, is worth observation when future studies consider similar investigations on time. In addition, while a particular set of measures were used to examine student writing CAF in this study, other important linguistic aspects that may be associated with any of the CAF have not yet been assessed. It would be a fruitful line of inquiry for future researchers to consider other linguistic features, such as lexical use for complexity and/or fluency. Lastly, and worth noting, the sample fell below the recognized minimum size for groups in experimental or correlation studies (i.e., 30 in each group; Groom & Littlemore, 2011) although writing classrooms are typically small and thus a group of 21 subjects as that in the current study may seem reasonable (cf. Gay,

1990; Lin, 2014, 2015a, 2015b). Future studies may contribute to a broader understanding of CAF studies by recruiting study samples of larger sizes.

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