Korean Journal of English Language and Linguistics, Vol 22, December 2022, pp. 1351-1367
DOI: 10.15738/kjell.22..202212.1351

KOREAN JOURNAL OF ENGLISH LANGUAGE AND LINGUISTICS

ISSN: 1598-1398 / e-ISSN 2586-7474

http://journal.kasell.or.kr

Automaticity in Writing: Investigating Positive Effects of Applying Formulaic Language in the L2 Writing Process*

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Received: October 25, 2022
Revised: December 03, 2022
Accepted: December 30, 2022

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* This work was supported by Hankuk University of Foreign Studies Research Fund.

ABSTRACT

Cho, Hyeyoung and Hyunsook Yoon. 2022. Automaticity in writing: Investigating positive effects of applying formulaic language in the L2 writing process. *Korean Journal of English Language and Linguistics* 22, 1351-1367.

Cognitive studies of language processing posit that formulaic language facilitates automaticity in the speaking process. This study extended the argument to writing to find evidence that the instructional effects of formulaic language can also improve L2 writers' automaticity and writing quality. The study operationalized automaticity to include both behavioral and cognitive domains, which was tested between two L2 writing groups in a Korean university: formulaic language and writing training group (FWG), which studied formulaic language as well as writing skills, and writing training-only group (WG), which was trained in writing skills without instruction about formulaic language. Results of automaticity and writing quality showed meaningful outperformance of the FWG against the WG, indicating instructional benefits of formulaic language. Also, it was found that the behavioral attributes of automaticity in the writing process can be strategically compromised to maintain writing quality. It is hoped that this study will prompt further investigation to improve our understanding of the automaticity in the writing process and to provide pedagogical implications for L2 writing instruction.

KEYWORDS

formulaic language, automaticity, writing process, writing quality, corpus-based instruction

1. Introduction

Automaticity has been studied extensively in skill acquisition theories (e.g., Anderson 1993, Logan 1988, 1990) and information processing theories of language development (e.g., Bates and MacWhinney 1989, MacWhinney 2001, Skehan 1998, VanPatten 1996). The studies have noted that complex skills such as language proficiency improve through the transition from controlled to more automatic processes. Automatic language processing can be demonstrated through the reduction in error rate, reaction time, and interference with other tasks in language performance (e.g., DeKeyser 2007, Segalowitz 2010). In particular, information processing theories noted that the use of large chunks of memorized language can assist automatic language processing (e.g., Bates and MacWhinney 1989, MacWhinney 2001, McLaughlin 1990, Skehan 1998, VanPatten 1996). The language chunks or the most frequently co-occurring word sequences are referred to as many terms, such as formulaic language, formulaic sequences, lexical bundles, and prefabricated phrases (Wray 2000). Bates and MacWhinney (1989) noted that language processing in comprehension and production can be automatized as formulaic language eases processing problems. Similarly, Skehan (1998) suggested that formulaic language is a significant processing resource that can be accessed and processed rapidly and relatively effortlessly. In this way, formulaic language enables language users to execute speech acts when there is little time available for planning what to say.

Empirical studies supported the facilitative role of formulaic language in language processing. Formulaic language is processed more quickly and efficiently than novel lexical strings, freeing up cognitive resources for better performance (e.g., Conklin and Schmitt 2008, Kuiper 1996, 2004, Tremblay, Derwing, Libben and Westbury 2011). Tremblay et al. (2011) reported that formulaic language was read and processed faster than non-formulaic language. For speech production, Kuiper (1996, 2004) noted that the language produced under severe time pressure includes more formulaic language than the one produced under less time pressure. In other words, formulaic language provides a cognitive shortcut for speakers who need time to plan and organize thoughts for language production. In terms of writing, Ohlrogge (2009) found that the better the writing quality is, the more formulaic language is used, hinting at the facilitative role of formulaic language in L2 writing. As Wray (2000) noted, formulaic language provides a writer with a processing shortcut, which saves cognitive efforts and ultimately leads to the native-like performance of non-native speakers.

Despite its critical role in language processing, formulaic language is significantly underexplored in the context of the automaticity of the writing process. Unlike speaking, which is a relatively simultaneous and real-time process, writing is highly recursive and cognitively effortful behavior, which includes constant decision-making not only on the lexical level but also on the syntactic, discourse, prosodic, and rhetorical levels (e.g., Alamargot and Chanquoy 2001, Chenoweth and Hayes 2003, Flower and Hayes 1981, Hayes 1996, Kellogg 1996). Given its complex nature, the cognitive process of writing seems to be difficult to be fully automatized (McCutchen 1988).

However, as Kellogg (2008) noted, the improvement of writing skills is accompanied by reduced cognitive efforts in sub-processes of writing such as organizing ideas, translating ideas into words, and reviewing. To elaborate, a skilled writer would go through a more automatized process than a less skilled writer with more cognitive resources available for high-level decision-making. In particular, using formulaic language would free up writer's cognitive capacity, which would improve the automaticity and, eventually, the quality of writing. The primary purpose of this study is to propose an operationalized concept of automaticity in writing and use it to measure the benefits of formulaic language in L2 writing. It is hoped that this study will propose a viable research framework for the investigation of automaticity in the writing process and provide a better understanding of the instructional effects of formulaic language.

2. Conceptualization of Automaticity in the Writing Process

Automaticity refers to "the whole process of knowledge change from initial presentation of the rule in declarative format to the final stage of fully spontaneous, effortless, fast, and errorless use of that rule" (DeKeyser 2007, p. 3). Further, Segalowitz (2003) explained that automaticity "draws on implicit-procedural knowledge and is reflected in fluent comprehension and production in lower neural activation patterns" (as cited in Ortega 2009, p. 85). A number of researchers have reported on multiple dimensions of automaticity, including quantitative and qualitative changes in cognitive processing (e.g., DeKeyser 2001, 2007, Dörnyei 2009, Phillips, Segalowitz, O'Brien and Yamasaki 2004, Segalowitz and Hulstijn 2005). In empirical studies, automaticity can be identified as a process with a low error rate, quick reaction time, and little interference from a secondary task after the proceduralization of a primary task (e.g., Favreau and Segalowitz 1983, Logan 1990).

The automaticity in the writing process has been largely assessed by the measurement of writing fluency. Depending on research goals, writing fluency has been defined and measured in different ways, such as words per minute (Ellis and Barkhuizen 2005), composing rate (Sasaki 2000), and text quantity (Baba 2009). Focusing on pausing behaviors in the writing process, Spelman Miller (2000) used multiple parameters to measure writing fluency, such as pause location, mean pause length, and pause frequency. In an attempt to identify a valid measure of writing fluency, Latif (2009, 2012) compared different measurements and claimed that writing fluency can be optimally assessed by the mean length of writers' translating episodes, which is defined as "a segment of the protocol that represents a chunk (one or more words) that has been written down and is terminated by a pause of three or more seconds or by any composing behavior" (2009, p. 537). Latif (2009) found that the mean length of the translating episodes increased through a multi-drafting process of writing and showed positive correlations with the writing quality as well as vocabulary and grammatical knowledge. Taking a multidimensional perspective, Van Waes and Leijten (2015) proposed a framework for a detailed examination of writing fluency, including production (mean number of characters), process variance (standard deviation of characters), revision (mean number of characters), and pause behavior.

It is noteworthy that the aforementioned investigations have by and large refined our understanding of the writing process. However, it has been a disjointed examination that largely concentrates on behavioral fluency in the writing process. Cognitive fluency in writing has been examined separately, with special attention on the use of working memory. Working memory provides cognitive support in the management of the writing process, which requires a series of skillful decision-making in multiple dimensions (e.g., Kellogg 1996, 2001, McCutchen 2000). The use of working memory in writing has been investigated by comparing writing performance between cognitive load and no-load conditions (e.g., Olive 2004, Ransdell and Gilroy 2001, Ransdell, Levy and Kellogg 2002). The studies found that minor cognitive loads, such as background music and unattended speech, place heavy demands on writers' working memory, reducing writing fluency. For instance, Ransdell et al. (2002) found that writers allocate working memory to maintain writing quality at the expense of fluency in dealing with minor cognitive loads. It is a strategy to maintain writing quality but fails when the working memory is insufficient against the overwhelming capacity of cognitive load. For instance, relatively high cognitive demands, such as a concurrent task of remembering six digits, significantly deteriorate writing fluency and quality.

The two separately examined attributes of the writing process – behavioral and cognitive fluency – could be grouped together to define the concept of writing automaticity, which represents high proficiency on both behavioral and cognitive levels. Segalowitz (2010) noted that automaticity indicates "greater processing efficiency" (p. 79), including skillful management of cognitive resources, demonstrated through improved behavioral performance. Studies noted that the automaticity in language processing could be identified by the rapidness, effortlessness, and ballistic nature of the processing (e.g., DeKeyser 2001, 2007, Dörnyei 2009, Hulstijn 2001, Segalowitz and Hulstijn 2005).

The high speed of processing is the most significant feature of automaticity (e.g., Lambert 1955, Logan 1988, 1990). Logan (1990) attributes automatization to the power-function speed-up in reaction time by focusing on quantitative improvements in cognitive activity. Besides the simple speed-up, the automatized processing can be characterized by ballistic, or unstoppable, performance (e.g., Favreau and Segalowitz 1983, Segalowitz 2003). Ballistic processing comprises uncontrollable responses (Logan 1988) and compulsory processing when set in motion (Rodgers 2007). The ballistic processing in writing can be investigated through writers' pausing behaviors such as pause frequency, location, and the number of words written down between pauses (e.g., Chenoweth and Hayes 2001, Latif 2009, 2012, Ransdell et al. 2002, Spelman Miller 2000). It can be assumed that a ballistic writing process would be less interrupted by pauses and include large chunks of text written between pauses.

Another characteristic of automatic processing is relevant to the consumption of working memory. The working memory is the site of rehearsal, practice, and assembly of language sequences (Baddeley 1983), the efficient operation of which is critical to the automatization of language processing. Anderson (1993) noted that when declarative knowledge is converted into procedural knowledge, the sequences of declarative rules are chunked and processed automatically, which reduces the consumption of working memory in language processing. In addition, Robinson (1995) suggested that in automatic language processing, the language chunks can be retrieved directly from procedural memory without the work of working memory. Studies suggested that the use of formulaic language alleviates the cognitive burden in language processing, supporting the language process to reach the level of automaticity (e.g., Kuiper 1996, 2004, Segalowitz and Hulstijn 2005, Tremblay et al. 2011).

Based on the multiple dimensions of automaticity, this study operationally defines automaticity in the writing process as a composite measure of behavioral and cognitive proficiency, demonstrated through high writing speed, ballistic processing with reduced interruption by pauses, and an increased capacity of working memory available. Using this operationalized concept of automaticity, the present study aims to measure the instructional effects of formulaic language in the L2 writing process and quality. This study compares the automaticity and writing quality between two groups: the formulaic language and writing training group (FWG), which studied formulaic language and writing skills; and the writing training only group (WG), which took writing classes without instruction on formulaic language. The following two research questions guide the investigation of this study:

1. Do FWG and WG show significant differences in the development of writing quality?
2. Do FWG and WG show significant differences in the development of automaticity in the writing process?

3. Methodology

3.1 Participants

The participants for this study came from two university-level L2 English writing classes in Korea, which included 20 students, respectively. Table 1 shows basic information about the participants. They were 22 years old on average and had studied English for an average of 12 years. They majored in various disciplines, such as business administration, law, and Japanese literature. Since all writing tests in this study were computer-based, the typing speeds of both groups were measured to examine group homogeneity. The mean typing speed of FWG was 48.20 words per minute (*SD* = 10.78), and that of WG was 47.05 words per minute (*SD* = 14.49). The independent *t*-test of typing speeds of the two groups showed no significant difference $t(35.1) = .778$, $p = .285$. Also, the initial writing quality was investigated, and there was no significant difference between the two groups $t(38) = -1.430$, $p = .161$.

Table 1. Description of FWG and WG

Group	N	Gender		Age (Yrs old)	Years of English education (Yrs)	Typing speed (WPM)	Pretest writing quality
		M	F	*Mean (SD)*	*Mean (SD)*	*Mean (SD)*	*Mean (SD)*
FWG	20	3	17	22.45 (1.64)	12.65 (1.81)	48.20 (10.78)	2.3 (0.92)
WG	20	2	18	22.40 (1.14)	12.40 (1.67)	47.05 (14.49)	2.65 (0.59)

3.2 Data Collection Procedures

Before the pretest, both groups learned how to use Inputlog, 5.0, a keystroke logging program to record their writing behaviors (Leijten and Van Waes 2012). The program was used to collect information on writing speed and pausing behaviors. On the same day, students took a pretest, which consisted of two writing tasks on different cognitive conditions. This study used a dual-task design appropriate for measuring the students' working memory availability (e.g., Ransdell et al. 2002). The capacity of working memory available in the writing process was gauged by comparing the writing performance under cognitive load with that under a baseline (no-load) condition. The pretest started with the no cognitive load condition and was followed by the cognitive load condition, each of which asked students to write an argumentative English essay on a randomly chosen topic from the independent writing task of the TOEFL test. The no cognitive load condition involved no extra task other than writing, while the cognitive load condition required students to write an essay with a concurrent task of memorizing and recalling a non-sequential six-digit number every five minutes continuously. Under the cognitive load condition, the instructor read aloud a non-sequential six-digit number every five minutes and asked the students to memorize and recall it after five minutes at the cue of “recall.” After the recall, the students were given a new six-digit to memorize, and the process continued until the end of the writing. For each writing task, ten minutes were given for planning and brainstorming, followed by thirty minutes of writing, which was logged by Inputlog 5.0.

During the eight weeks after the pretest, FWG and WG were instructed by the same instructor. The classroom instruction consisted of two parts: activities on the main textbook and learners' corpus consultation. In the first part of the class, both groups received 20-25 minutes of lecture on basic concepts and principles of writing by using the textbook “Writing Academic English” (Oshima and Hogue 2006), followed by relevant textbook activities such as reading, solving comprehension and vocabulary questions, and short writing practice.

After a ten-minute break, the second part of the class started with giving a weekly list of search terms for corpus consultation. The FWG group was given a list of formulaic expressions selected from the Academic Formulas List (AFL) (Simpson-Vlach and Ellis 2010), while the WG group was given a list of single words matching those in the formulaic expressions that were given to the FWG group. In addition to the AFL, this study included several formulaic expressions frequently used in argumentative essays, which were chosen from “TOEFL writing (TWE) topics and model essays” (Wayabroad company 2002), a collection of model essays and writing templates of argumentative essays. The inclusion was necessary because this study used argumentative writing as a test.

A short lecture was given to the students to assist their understanding of the given list. The lecture for the FWG was focused on semantics and usages of the formulaic sequences, while the lecture for the WG was usually about the grammatical functions. The grammatical focus of the lectures for the WG was appropriate because the single search terms, such as articles, modal verbs, and prepositions, required relevant grammatical explanations for a proper understanding of the search terms.

After the lecture, students visited the Corpus of Contemporary American English (COCA) website and searched the data on a given list of search terms for 30 minutes. The learners' corpus consultation process in this study started with the learners' identification of needs for corpus inquiry. The learners were asked to choose search terms from the list, which they found interesting, important, or difficult to understand. In this way, the learners were able to analyze the usage of search terms in the rank order of personal learning needs and interests. During the learners' corpus consultation, the FWG group searched the use of formulaic language (e.g., *with respect to, the extent to which*) while the WG group searched exactly the same but individual words (e.g., *respect, extent, which*). The corpus consultation was followed by examining the retrieved search results to decide whether to refine or terminate the query. During the phase of decision-making, students needed to identify which words, expressions, phrases, or sentences from the concordance lines would be of value to them in their future L2 writing and write them down on their worksheets. When the corpus query on a particular search term ended, another query on a new search term started, and the process continued until the instructor asked students to close up the corpus analysis. After the students' corpus consultation, they made a short oral presentation about their findings from corpus analysis and were provided with feedback and explanations of their findings from the instructor. When the learners made mistakes in interpreting corpus data, the instructors corrected them and provided appropriate usage with samples in the concordances. In this way, the students were able to consolidate their knowledge of search terms and share their findings.

In the 10th week, both groups took an immediate posttest, which consisted of two argumentative writing tasks – one under no cognitive load and the other under load conditions. From weeks 11 to 13, there was no instruction on formulaic language for FWG, and the two groups received the same lectures on stylistic considerations in English writing. This study used an interim period of no instruction of formulaic language to measure the enduring effect of the instruction at the time of the delayed posttests. In the 14^{th} week, students took a delayed posttest under two cognitive conditions, the same as they did in the pretest and the immediate posttest.

3.3 Measurements of Automaticity

This study used three parameters of automaticity, i.e., speed of processing, ballistic processing, and the capacity of working memory available, which allow a systematic analysis of behavioral and cognitive proficiency of the writing process. The two former parameters were to investigate behavioral proficiency, and the latter was used to assess cognitive proficiency in the management of the writing process. This study measured the speed of writing by words per minute (WPM), which has served as a traditional measurement of writing fluency (e.g., Ellis and Barkhuizen 2005).

Ballistic processing was related to how unstoppable the writing process was, which required an examination of writers' pausing behaviors. Among various measurements of writing fluency, the mean length of translating episodes was the most valid one (e.g., Latif 2012), which examined the writers' ability to produce texts without significant interruption by pauses. The mean length of translating episodes can be measured by the mean number of words written down and terminated by a pause of three seconds or longer.

The working memory capacity was gauged by paired *t*-test results of speed of processing, ballistic processing, and writing quality between cognitive load and no-load conditions (e.g., Ransdell et al. 2002). Within a dual-task design, this study compares the writing speed, ballistic processing, and writing quality between cognitive load and no-load conditions. Since the cognitive burden (six-digit number memorization) would have a weaker impact on a writer who had a sufficient capacity of working memory available than on one who did not, a non-significant value of paired *t*-tests of writing performance between cognitive load and no-load conditions could be interpreted as the writer having been equipped with sufficient working memory available to handle the cognitive burden without significant deterioration in writing performance in comparison to the baseline results (i.e., no cognitive load condition). The overall description of the measurements of automaticity is presented in Table 2.

Table 2. Measurements of Automaticity

Parameter	Measurement
Speed of processing	Words per minute (WPM) (Ellis and Barkhuizen 2005)
Ballistic processing	Mean length of translating episodes (Latif 2012)
The capacity of working memory available	Comparing means of speed of processing, ballistic processing, and writing quality between conditions under cognitive load (six-digit number recall) and no cognitive load (no recall) by paired *t*-tests (Ransdell et al. 2002)

3.4 Data Analysis

The writing quality was rated by two native English-speaking instructors, who were born and educated in English-speaking countries and have academic careers in TESOL for longer than eight years. For reliable results, the raters were asked to judge the essays referring to a holistic rubric developed by ETS (Weigle 2002) and compare their results. When the grading results were different, they discussed them and chose one grade based on the rubric. The highest score for writing was six, and the lowest was zero. The inter-rater reliability test for the two raters reached a Pearson correlation of $r = .929$ ($p < .001$).

Further, to examine the students' use of formulaic language in writing, this study performed cluster analysis by the function of Wordsmith 5.0. Formulaic sequences of 2 to 5 words were included to identify comprehensive uses of formulas (Groom 2009). Students' writings under two cognitive load conditions over three testing sessions, i.e., pretests, immediate and delayed posttests, were used to create six corpora for each group (i.e., a total of 12 corpora). Wordsmith 5.0 calculated the total frequency of formulas and the number of formula types in each corpus. The cut-off point of the minimum frequency of formulas was set to five.

Examination of the three parameters of automaticity required information about the total writing time, the number of words, and the number of pauses of three seconds or longer, which were provided by the logging files of Inputlog 5.0. The WPM of this study was calculated by division of the total number of words by the total writing time. The mean length of translating episodes was measured by the division of the total number of words by the total number of pauses of three seconds or longer. The working memory availability was gauged by paired *t*-test results of speed of processing, ballistic processing, and writing quality between cognitive load and no-load conditions. The results of WPM, mean length of translating episodes, and writing quality were subjected to both descriptive and inferential statistics by SPSS 16.0.

4. Results and Discussion

4.1 Writing Quality

In order to answer the first research question, this study examined the writing quality of the two groups, the results of which are provided in Table 3.

Table 3. Writing Quality

Condition	Group	Pretest	Immediate posttest	Delayed posttest	Within-subject one-way ANOVA
		M (SD)	*M (SD)*	*M (SD)*	
No-load	FWG	2.30 (0.92)	3.15 (0.75)	3.85 (0.93)	$F(2, 38) = 38.479$, $p < .001$*, $\eta^2 = .669$
	WG	2.65 (0.59)	2.90 (0.85)	2.95 (0.39)	$F(1.534, 29.143) = 1.906$, $p = .174$, $\eta^2 = .091$
Load	FWG	2.45 (0.76)	3.10 (0.64)	3.95 (0.83)	$F(2, 38) = 80.130$, $p < .001$*, $\eta^2 = .808$
	WG	2.55 (0.51)	2.90 (0.64)	2.45 (0.76)	$F(2, 38) = 3.606$, $p = .037$*, $\eta^2 = .160$

To examine homogeneity, independent *t*-tests were performed on the pretest under cognitive load and no-load conditions. This revealed no significant group difference in the pretests under no cognitive load $t(38) = -1.430$, $p = .161$, and load conditions $t(38) = -.489$, $p = .628$. Two-way repeated-measure ANOVAs were used to identify group differences in the development of the writing quality, and results showed significant group by time interactions under no cognitive load $F(1.8, 68.7)=13.38$, $p<.001$ $\eta^2=.260$ and cognitive load conditions $F(2, 76) = 32.09$, $p < .001$, $\eta^2 = .458$. The result suggested that the two groups showed significant differences in writing quality after the eight weeks of instruction. Results of within-subject one-way ANOVA tests show that FWG made significant improvements under no cognitive load $F(2, 38) = 38.479$, $p < .001$, $\eta^2 = .669$ and cognitive load $F(2, 38) = 80.130$, $p < .001$, $\eta^2 = .808$. It contrasts with WG, which showed no significant development under no cognitive load condition $F(1.534, 29.143) = 1.906$, $p = .174$, $\eta^2= .091$. Under the cognitive load, WG reported significant differences $F(2, 38) = 3.606$, $p = .037$, $\eta^2 = .160$, but its mean score of the delayed posttest ($M = 2.45$, $SD = 0.76$) was lower than that of the pretest ($M = 2.55$, $SD = 0.51$), indicating that WG failed to make improvements in writing quality both under cognitive load and no-load conditions.

The significant group difference in writing quality can be explained by the instructional benefits of formulaic language. Through eight weeks of instruction, FWG learned semantics and usage of formulaic language, which would assist the students in applying them properly in their writing. The benefit of formulaic language is also reported by Ohlrogge (2009), suggesting that higher-quality writing tends to include a greater variety of formulaic language. However, despite receiving instruction on writing for eight weeks, WG seemed to fail to achieve the same development as FWG. Given the meaningful group difference in the development of writing quality, the result of this study suggests the importance of formulaic language in improving writing quality.

In order to test the suggested explanation for the improved writing quality of FWG, this study examines the total frequency and types of formulaic language in the students' writing. The investigation of the use of formulaic language could provide an accurate indication of its instructional effects in improving writing quality. Table 4 presents the total frequency of formulas of both groups over three testing periods.

Table 4. The Total Frequency of Formulas

Condition	Group	Formula frequency			Chi-square results		
		Pretest	Immediate posttest	Delayed posttest	χ^2	*df*	*p*
No-load	FWG	943	2395	1793	6.223	2	.000*
	WG	1076	1875	1303	2.391	2	.000*
Load	FWG	1932	2119	1984	9.262	2	.010*
	WG	1631	1692	1666	1.127	2	.569

The result shows that FWG increased the use of formulaic language in the immediate and delayed posttests under no cognitive $\chi^2(2) = 6.223$, $p < .001$ and cognitive load conditions $\chi^2(2) = 9.262$, $p = .010$. As a side note, the frequency peaked in the immediate posttest and then reduced in the delayed posttest, indicating that the instruction effect wore off during three weeks of the interim period. However, it is still meaningful to find a significant improvement in the frequency of formulas in two posttests from the pretest. WG also increased the frequency under no cognitive load conditions $\chi^2(2) = 2.391$, $p < .001$, but under cognitive load, the students of WG did not increase the use of formulaic language $\chi^2(2) = 1.127$, $p = .569$. This indicates that both groups enhanced the use of formulaic language through instruction, but only FWG was able to maintain the improvement under cognitive load. Considering the significant improvement of the writing quality of FWG under cognitive load conditions, the result suggests that FWG might use formulaic language as a strategy to deal with extra cognitive load and save cognitive efforts in language processing to produce good writing.

With the increased frequency of formulaic language of FWG, a question arises whether it is a result of using various types of formulaic language or recycling limited expressions. The number of formula types was calculated to answer this question, which is presented in Table 5.

Table 5. The Number of Formula Types

Condition	Group	Number of formula types			Chi-square results		
		Pretest	Immediate posttest	Delayed posttest	χ^2	*df*	*p*
No-load	FWG	102	200	190	35.463	2	.000*
	WG	110	153	140	7.241	2	.027*
Load	FWG	155	172	178	1.691	2	.429
	WG	131	141	155	2.042	2	.260

The chi-square results indicate that both FWG and WG students significantly diversified the types of formulaic language under no cognitive load conditions ($\chi^2(2) = 35.463$, $p < .001$ for FWG and $\chi^2(2) = 7.241$, $p = .027$ for WG), but under cognitive load, neither group showed a significant increase in the type of formulaic language ($\chi^2(2) = 1.691$, $p = .429$ for FWG and $\chi^2(2) = 2.042$, $p = .260$ for WG). This suggests that in dealing with extra cognitive load, both groups refrained from using novel sets of formulaic language. In particular, given FWG's increased frequency of formulaic language under cognitive load, it can be concluded that FWG benefited from the instruction of formulaic language by recycling the limited types of formulaic language when dealing with the cognitive load.

4.2 Automaticity of the Writing Process

The second research question addresses group differences in the development of the automaticity of the writing process. To answer this question, this study measures three parameters of automaticity of writing: the speed of processing, the ballistic processing, and the capacity of working memory available. The speed of processing is how fast the writing process is. Table 6 displays the results of words per minute (WPM) of each group under two conditions (no cognitive load and cognitive load) over the three testing periods (pretest, immediate posttest, and delayed posttest). In order to examine the group homogeneity, this study performed independent *t*-tests of the pretests and found no statistically significant difference under no cognitive load $t(38) = 0.890$. $p = .379$ and load conditions $t(38) = -.464$, $p = .645$.

Table 6. Words Per Minute

Condition	Group	Pretest	Immediate posttest	Delayed posttest	Within-subject one way ANOVA
		M (SD)	*M (SD)*	*M (SD)*	
No-load	FWG	7.86 (1.80)	8.84 (1.99)	9.17 (2.56)	$F(2, 38) = 3.365$, $p = .045$*, $\eta^2 = .150$
	WG	7.32 (2.02)	8.70 (2.8)	8.26 (2.46)	$F(2, 38) = 4.90$, $p = .013$*, $\eta^2 = .205$
Load	FWG	7.15 (1.51)	8.19 (2.24)	8.09 (1.98)	$F(2, 38) = 4.670$, $p = .015$*, $\eta^2 = .197$
	WG	7.44 (2.35)	7.36 (2.17)	7.36 (2.45)	$F(2, 38) = .026$, $p = .974$, $\eta^2 = .001$

Table 6 demonstrates that the two groups improved WPM over time, except for WG under the cognitive load condition, whose results of immediate and delayed posttests were lower than that of the pretest. In order to examine the group difference, two-way repeated measure ANOVAs were performed and showed no significant group difference under no cognitive load $F(2, 76) = .611$, $p = .545$, $\eta^2 = .016$ and load conditions $F(2, 76) = 2.51$, $p = .088$, $\eta^2 = .062$, indicating no meaningful group difference in writing speed after instruction.

Ballistic processing measures the amount of undisruption (continuity) in the writing process. Ballistic processing was evaluated by the mean length of translating episodes, which is presented in Table 7. Independent *t*-tests on the pretest under the two cognitive conditions revealed no statistically significant group difference under no-load $t(38) = -.159$, $p = .875$ and load conditions $t(38) = -.800$, $p = .429$. In examining different instructional effects of the two groups, two-way repeated measure ANOVAs were used and found no significant result under no cognitive load $F(1.17, 44.48) = .521$, $p = .502$, $\eta^2 = .014$ and load conditions $F(1.77, 67.21) = .810$, $p = .436$, $\eta^2 = .021$. Further, one-way ANOVA tests showed that only WG, under the no-load condition, improved in the ballistic processing $F(2, 38) = 9.564$, $p < .001$, $\eta^2 = .335$, suggesting no meaningful effect of instruction of formulaic language to improve the ballistic processing in writing.

Table 7. Mean Length of Translating Episodes

Condition	Group	Pretest		Immediate posttest		Delayed posttest		Within-subject one-way ANOVA
		M	*SD*	*M*	*SD*	*M*	*SD*	
No-load	FWG	2.75	1.38	4.27	5.06	4.34	4.40	$F(1.05, 19.99) = 3.424$, = .078, $\eta^2 = .153$
	WG	2.81	1.14	3.98	2.01	3.65	1.63	$F(2, 38) = 9.564$, $p < .001$*, $\eta^2 = .335$
Load	FWG	2.62	0.86	3.36	1.83	3.13	1.72	$F(1.59, 30.25) = 2.978$, $p = .076$, $\eta^2 = .136$
	WG	2.86	1.05	3.10	1.47	3.17	1.53	$F(2, 38) = .891$, $p = .419$, $\eta^2 = .045$

The result of writing speed and ballistic processing reports no significant group-by-time interaction, suggesting that the instructional effect of formulaic language is negligible in the development of behavioral proficiency in the writing process. The finding is worthwhile as it challenges two common assumptions about L2 writing instruction: first, formulaic language would facilitate behavioral proficiency, and second, the fluent writing process would lead to high-quality writing. First, studies suggest that the use of formulaic language reduces cognitive efforts by facilitating language processing (e.g., Conklin and Schmitt 2008, Kuiper 1996, 2004, Tremblay et al. 2011). However, FWG in this study did not outperform WG in behavioral proficiency, suggesting that the improved lexical processing through formulaic language has only limited influence on behavioral proficiency in the writing process. It can be explained by the cognitively demanding nature of the writing process (e.g., Alamargot and Chanquoy 2001, Chenoweth and Hayes 2001, Hayes 1996, Torrance and Galbraith 2006), in which the fast lexical processing is only a fraction of the overall efficiency of the writing process. Second, given the FWG's significant outperformance of writing quality, the negligible group difference in behavioral proficiency suggests that writing development is not necessarily reflected in the behavioral proficiency of the writing process. Some studies suggest a positive relationship between writing fluency and writing quality (e.g., Latif 2009), but it should be noted that a writer may choose to reduce the writing speed to produce good writing through careful deliberation (e.g., Ransdell et al. 2002, Torrance and Galbraith 2006).

The last parameter of automaticity to examine is the capacity of working memory available, which was investigated by comparing writing performance (i.e., writing speed, ballistic processing, and writing quality) between cognitive load and no-load conditions. Unlike the two previous parameters, the analysis of the capacity of working memory available does not provide independent *t*-tests to examine group homogeneity because working memory capacity is indexed by the results of paired *t*-tests of performance variables between cognitive load and no-load conditions. Hence, to examine the group homogeneity, due attention should be given to the pretest results of paired *t*-tests (as presented in Tables 8, 9, and 10). The results showed non-significant differences between cognitive load and no-load conditions, indicating that both groups were equipped with sufficient working memory available to handle the cognitive load without significant deterioration in the writing process or writing quality.

Table 8 displays paired *t*-test results of WPM between no cognitive load and load conditions. Unlike the pretest, both groups showed significant differences between the two conditions in immediate and delayed posttests. The results indicate that a substantial capacity of working memory was consumed to maintain writing speed in the posttests under cognitive load compared to no-load conditions. It seems that after writing instruction, the two groups increased the consumption of working memory, which significantly deteriorates the speed of writing under cognitive load conditions. The same change in the two groups suggests that it is the result of the writing instruction, not that of the instruction of formulaic language. As students learn basic principles and rules of writing through instruction, they have more things to consider in the writing process, consuming more working memory than they did in the pretest. Dealing with the extra cognitive burden under the load condition, the students seemed to decide to sacrifice writing speed to compensate for the limited availability of working memory.

Table 8. Paired *t*-tests of Speed of Processing Between No Cognitive Load and Load Conditions

Group	Speed of processing (words per minute)		
	Pretest	Immediate posttest	Delayed posttest
FWG	$t(19) = 1.59, p = .128$	$t(19) = 2.897, p = .009$*	$t(19) = 3.274, p = .004$*
WG	$t(19) = -.419, p = .680$	$t(19) = 3.321, p = .004$*	$t(19) = 3.221, p = .004$*

Table 9 reports the results of working memory in maintaining ballistic processing. Unlike the results of the use of working memory in maintaining writing speed, FWG showed no statistically significant difference between load and no-load conditions in immediate $t(19) = 1.201, p = .245$ and delayed posttest $t(19) = 1.939, p = .068$, while WG showed significant differences in immediate $t(19) = 22.677, p = .015$ and delayed posttests $t(19) = 2.648, p = .016$. The results of the posttests indicated that FWG exhibited no significant deterioration of ballistic processing under cognitive load, compared to the performance under no-load conditions. On the other hand, WG showed significantly less ballistic processing under the cognitive load than no-load, presumably due to substantial consumption of working memory dealing with the extra cognitive load. The WG's strong working memory consumption in the posttests became more noticeable than its non-significant result of pretest $t(19) = -.364$, $p = .720$. The significant group difference can be explained by the different instruction. For FWG, the student's knowledge of formulaic language might work to secure more working memory to maintain ballistic processing under cognitive load. On the other hand, WG seemed to fail to manage the ballistic processing while dealing with extra cognitive load. Given the increased consumption of working memory of the two groups after the instruction (as demonstrated by the significant deterioration of writing speed under cognitive load), the result of FWG in ballistic processing suggests meaningful instructional benefits of formulaic language to manage the use of working memory under cognitive load.

Table 9. Paired *t*-tests of Ballistic Processing Between No Cognitive Load and Load Conditions

Group	Ballistic processing (Mean length of translating episodes)		
	Pretest	Immediate posttest	Delayed posttest
FWG	$t(19) = .459$, $p = .651$	$t(19) = 1.201$, $p = .245$	$t(19) = 1.939$, $p = .068$
WG	$t(19) = -.364$, $p = .720$	$t(19) = 2.677$, $p = .015$*	$t(19) = 2.648$, $p = .016$*

The investigation on the use of working memory also reports the FWG's outperformance in maintaining writing quality. As shown in Table 10, FWG's immediate and delayed posttests showed no significant difference between cognitive load and no-load conditions, while WG showed a significant difference in the delayed posttest $t(19) = 2.939$, $p = .008$. It suggests that WG's writing quality of the delayed posttest significantly deteriorated under cognitive load than under no-load conditions, while FWG maintained the writing quality under cognitive load. Unlike WG, the result indicates that FWG was assisted by the instructional benefit of formulaic language to maintain writing quality when handling additional cognitive burdens in the writing process. In addition, it is noteworthy that the instructional effect of FWG was obtained not only in the immediate posttest but in the delayed posttest, suggesting the enduring effects of the instruction.

Table 10. Paired *t*-tests of Writing Quality Between No Cognitive Load and Load Conditions

Group	Writing quality		
	Pretest	Immediate posttest	Delayed posttest
FWG	$t(19) = -1.143$, $p = .267$	$t(19) = .438$, $p = .666$	$t(19) = -.698$, $p = .494$
WG	$t(19) = .698$, $p = .494$	$t(19) = .000$, $p = 1.000$	$t(19) = 2.939$, $p = .008$*

All in all, despite the deterioration in writing speed under cognitive load, FWG was able to maintain ballistic processing and writing quality, which is in contrast to WG. Both groups seem to sacrifice writing speed to deal with extra cognitive load, but only FWG successfully kept the ballistic processing and the quality of writing. Presumably, due to the lack of working memory availability, WG deteriorated the ballistic processing and writing quality in dealing with the extra cognitive load. The result demonstrates the instructional benefits of formulaic language, which allows FWG more working memory to deal with additional cognitive load and eventually produce good writing. In addition, the finding of this study corresponds with the study of Ransdell et al. (2002), which reported writers' strategic decision to compromise writing speed in dealing with cognitive load to maintain writing quality. They also noted that the strategy fails when the cognitive load is overwhelming, as the WG of this study deteriorated their overall writing performance under cognitive load conditions.

5. Conclusion

This study investigated the instructional effects of formulaic language to improve the automaticity and quality of L2 writing. Employing the operationalized concept of automaticity in the writing process, this study compared behavioral and cognitive proficiency between two groups: FWG, which studied formulaic language with writing instruction, and WG, which took writing instruction without learning formulaic language. Results showed that FWG significantly outperformed WG in writing quality as well as the use of formulaic language. In terms of automaticity, the two groups showed no meaningful difference in behavioral proficiency, but FWG outperformed WG in the development of cognitive efficiency. In dealing with cognitive load, FWG compromised writing speed only, while WG deteriorated ballistic processing and writing quality as well as writing speed, hinting that FWG has more capacity of working memory available than WG in managing cognitive load in the writing process.

In addition, the finding of this study suggested that writing speed can be compromised to maintain writing quality. As Torrance and Galbraith (2006) explained, the writing process can be easily disrupted even for skilled writers. Although writers were fully aware of what to say in writing, disruptions in writing are unavoidable in nature. The recursive and cyclical writing process requires stop-start behaviors, which could be strategic moves for improving writing quality on the continuum of planning, translating, and revising. Also, the finding provides insights into the relationship between writing fluency and quality. Depending on how to define writing fluency, previous studies reported different results on the relation between writing fluency and quality (e.g., Knoch, Rouhshad and Storch 2014, Latif 2009, Ransdell et al. 2002). The finding of this study suggests that cognitive proficiency has a tangible effect on writing quality, while behavioral proficiency can be sensibly sacrificed to produce good writing.

The findings of this study also come with limitations. Within a quantitative research design, this study left the changes in participants' attitudes or perceptions of the writing process unexplored. The students' reaction to the instruction should provide valuable resources to understand the cognitive process of writing and the instructional benefits of formulaic language. Future research is needed to take a qualitative approach to investigate the affective aspects of participants through surveys and interviews. In addition, the small number of participants with 14 weeks of instruction may limit the generalizability of the research findings. The number of participants was 20 in each group, which may affect the results of statistical analysis, and the participants may require extended periods of instruction to produce more tangible outcomes in writing. It is hoped that future studies will adopt the research framework of this study with more participants in a longer duration to gain more robust evidence for the instructional effects of formulaic language in L2 writing.

Despite some limitations, this study may open a new avenue for assessing the writing process and finding instructional benefits of formulaic language in L2 writing. Exploring the concept of automaticity to examine behavioral and cognitive proficiency, this study provides a research framework for the systematic investigation of the writing process and discovers the significant role of formulaic language in improving cognitive proficiency and writing quality. Further, this study reports writers' strategic decisions to compromise their behavioral proficiency to maintain writing quality under cognitive load. Based on this study's methodological and pedagogical implications, it is hoped that future research will further the understanding of the writing process and advance the instruction of formulaic language in the L2 writing classroom.

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Examples in: English
Applicable Languages: English
Applicable Level: Tertiary

Appendix.

Example of expressions for corpus consultation (Adapted from Simpson-Vlach and Ellis, 2010)

	FLG	WG
week 2	in terms of the/with respect to in the case of/in this case/ when it comes to the relationship between/ in relation to/ related to/associated with the in the sense that/ by the same token from the point of view/ as well as generally speaking	important/importance serious/ premier/ real/ interested most / more/ numerous/ some/few/each different/difference short/ large/ other/ due/same
week 3	*as a result of/ in order to* *this is a/there is no/ it is not/ that there is a* *a number of/ the number of /large number of /the amount of* *a variety of/a series of* *the extent to which/to some extent* *the way in which/ways in which* *I would explain*	*related/associated/relationship/relation* *result/suggest/explain/refer/function* *sense/see/use/respect/face/come/cast* *complete/follow* *opposed/contrast*

Note. The selection of formulaic expressions and individual words for each week was made based on speech functions (for the FLG) and part of speech (for the WG).