



Statistical Analysis of Student Performance in Free Writing in English

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Japanese university students are often assigned free writing activities in their English language classes to improve writing in English. Free writing is “the act of writing quickly for a set time from ten to fifteen minutes, just putting down whatever is in the mind, without pausing and worrying about what words to use, and without going back to modify what has been written” (Li, 2007, p. 42). While free writing has been used in English classrooms in Japan, there is a lack of longitudinal statistical analysis related to students’ written words per minute. This paper reports on the statistical analysis of 3 years’ worth of student free writing data to investigate the efficacy of using free writing in EFL classrooms. Results of paired t-test, cluster analyses, and regression analyses of student performance demonstrated that there is no generalizable, statistically significant improvement in the number of words produced by students through long-term free writing practice. This aligns with the findings of existing quantitative research.

日本の大学生は、英語の授業で英語のライティング力向上のためにフリーライティングを課されることが多い。フリーライティングとは、「10分から15分の決められた時間内に、頭に浮かんだことをただ書き出すことであり、途中で立ち止まったり、どの言葉を使うか悩んだり、書いたものを修正したりしないこと」(Li, 2007, p. 42)である。本論文では、EFL教室におけるフリーライティングの有効性を調査するため、3年間にわたる学生のフリーライティングデータの統計分析を報告する。学生のパフォーマンスに対する対応のあるt検定、クラスター分析、回帰分析の結果、長期的なフリーライティング練習を通じて学生が産出する単語数に、一般化可能で統計的に有意な改善は見られなかった。結果は、既存の定量的研究の知見と一致している。また、フリーライティングのトピック選択と指導法に関する推奨事項も提示する

Language teachers have used free writing in foreign language writing instruction for decades, ever since Jacobs’ (1986) concept of *quickwriting* and Fox and Suhor’s (1986) *free writing* coined terms formalizing the practice. Li (2007) defined free writing as “writing quickly for a set time from ten to fifteen minutes, just putting down whatever is in the mind, without pausing and worrying about what words to use, and without going back to modify what has been written” (p. 42). Rivers (2007) clarified free writing as writing continuously for a set time without pausing, thinking, or correcting. Darling (2018) explained that free writing could be either *guided*—with a teacher-defined topic—or *unguided*—with a student-chosen topic. Many language teachers in Japan have used free writing activities to encourage learners’ confidence and fluency in foreign language writing (Azizi, 2015; Baba & Nitta, 2014; Darling, 2018; Ferreira, 2013; Forsythe & MacWhinnie, 2023, 2024; Muller, 2014a, b; Piper, 2015; Rivers, 2007; Townsend, 2023).

Although free writing is a long-standing practice in foreign language education, its efficacy has not been thoroughly researched in the context of Japanese universities’ English as a Foreign Language (EFL) program (Ferreira, 2013). Although some studies, such as those by Baba and Nitta (2010, 2014) and Herder and King (2012), identified sporadic increases in the numbers of words per minute (WPM) written through free writing practice, no studies were found that statistically analyzed the data of student writing production to determine whether the students were producing statistically significant increases in words produced across a period of free writing practice. Therefore, this study aims to address this gap in research by exploring whether Japanese university students’ written production increases in a statistically significant way through the practice of free writing in EFL writing classes. This study expands on Baba and Nitta’s (2010, 2014) and Muller’s (2014a, 2014b) studies exploring the efficacy of free writing in EFL classrooms. The research question that guided this study was:

RQ1. Did students’ free writing fluency as measured in WPM improve statistically significantly over the course of 1 year of 10-minute weekly timed writing?



Literature Review

Fox and Suhor (1986) found that free writing encouraged learners to write less formally, but that the practice did not “automatically produce better writers” (p. 35). Bello (1997) recommended free writing to improve EFL writing skills and used it to launch into more extensive process writing (p. 2). Later, Elbow (1998) recommended free writing because it enabled learners to write more fluently without worrying about making mistakes. Li (2007) provided a strong rationale for using free writing to promote students’ general academic skills (p. 51) but did not focus on using free writing to improve writing fluency. These are a few examples of the foundational research into free writing in language learning, but they represent conflicting views about its efficacy in the EFL classroom.

Free writing as a writing improvement activity has been used for decades to varying degrees of success, and many researchers such as Broekema (2020) found that Japanese university EFL students found free writing to be fun, but difficult. Ultimately, they perceived it as worthwhile for assisting their English writing skills. In a Japanese university EFL context, free writing has been recommended for teaching writing (Ohno, 2002), even in the face of strong reluctance due to lack of teacher confidence (Iseno, 1991) and some skepticism in the process (Rivers, 2007). Because few Japanese high school students have experience with free writing (Darling, 2018; Inoue, 2022; Townsend, 2023), this lack of familiarity with free writing carried over into university EFL classes. Therefore, Bradley (2013) recommended improving EFL writing instruction through simple and well-explained free writing activities, and Rivers (2007) recommended free writing as a tool to improve Japanese university students’ creativity in writing with minimal demands on the teacher for preparation or feedback.

Production in Terms of Words per Minute

Following such recommendations, several instructors have used free writing in Japanese EFL writing classes. Several researchers have used the number of words written per minute (WPM) as a measure of writing fluency. Herder and King (2012) used WPM as a measure of student writing fluency and observed modest improvement over time in their study of Japanese high school EFL students doing free writing over a one-year timeframe (p. 129). Muller (2014a, 2014b) evaluated the use of free writing in Japanese EFL classrooms in both high school (2014a) and university settings (2014b). In the high school-based study, Muller (2014a) analyzed the number of words produced as a measure of writing fluency and found that the students did not increase the number of words

produced over the course of the semester. Muller’s (2014b) university-based study found that through a year of weekly free writing activities, there was no notable difference in the number of WPM produced (p. 33). Regarding the time limits for the free writing activities, Muller (2014a, 2014b) used both 5-minute and 10-minute writing periods and found no evidence that more writing time equated to more WPM produced (p. 34).

Baba and Nitta (2014) also explored the effects of regular, 10-minute free writing on a given topic with two Japanese university students over a 30-week study. As with Herder and King’s (2012) study, Baba and Nitta (2014) found that the participants’ average WPM fluctuated weekly, but the data indicated an overall upward trend in the number of WPM (pp. 15-23), contradicting Muller’s (2014b) findings but with a vast difference in the number of study participants. Baba and Nitta (2014) recommended repetitive free writing practice to improve writing fluency over the course of a semester or longer.

Azizi (2015) continued the exploration of free writing in Japanese EFL settings with research similar to Muller’s (2014b) that analyzed the WPM of the participants’ computer-based free writing activities over a 9-week term. Unlike previous similar research, Azizi found an average improvement of 43 WPM among 36 Japanese university student participants (p. 86). In contrast, Forsythe & MacWhinnie (2023) found no consistent improvement in WPM over a semester or a year of weekly free writing in a 141-participant study across three years of data collection (p. 206). However, they did not analyze the data for statistical significance.

Impact of Topic Selection on Free Writing Efficacy

Regarding the topics used in free writing, Muller (2014a) found that students prefer to be given a topic to write about, and Darling (2018) reported that participants were okay with either teacher-provided or self-selected topics (p. 22). Ferreira (2013) found that participants seemed “to express themselves with a larger variety of words when asked to write about topics of their own choosing” (p. 304). Ottoson & Crane (2017) found students stated a preference for assigned topics but demonstrated increased fluency in self-selected topics (pp. 53-55). As with Ottoson and Crane (2017), Piper (2015) also researched topic choice in free writing and found that students performed marginally better when writing about teacher-provided topics (p. 120). Piper also showed that half of the participants preferred teacher-provided topics because the students had difficulty in deciding content when they were left to choose the topic (p. 126). Forsythe and MacWhinnie (2024) found that topics can have a limiting effect on the participants’ writing fluency. Further, their research showed that self-selected topics could result in

greater production in writing, but overall, the selection of free writing topics has little influence on how much the students write (p. 79).

One theme that seems to be constant across the current research of Japanese university students' written production from free writing activities: the quantitative data does not always reveal increases in the amount of English produced over time, and the research reviewed by the authors did not include statistical analysis of the participants' free writing WPM data. To fill this gap in the literature, the authors performed statistical analysis on quantitative data collected to determine whether the changes in WPM observed were statistically significant in free writing in English.

Methods

Participants

The participants of this study were 81 freshmen English majors at a private university in northern Japan. Demographic information about the participants was not collected in this study to maintain anonymity. All participants were informally assessed by authors to be approximately at the CEFR A2 – B1 level of proficiency based on interactions and performance in the classroom. Free writing activities were done during the required English Composition classes for the entirety of participants' first year. Informed consent was obtained from all of the participants at the beginning of the data collection period, and students were given the option to opt out of the study at any time.

Data Collection

All of the free writing done in this study was done in the classroom by hand in order to eliminate the confounding variables of variances in participants' computer and typing proficiency. Students were given a worksheet with three different topics for each week's free writing assignment (see the Appendix for full list of topics). Free writing topics were adapted from *American Headway* Levels 1 and 2 (Soars & Soars, 2016) textbook topics with slightly more difficult topic options also provided. A variety of topics was provided to account for differences in students' abilities and interests, as recommended by Baba and Nitta (2014).

Students were instructed to choose a topic and then write about it for two consecutive weeks of free writing activities. Students were given 10 minutes at the end of class for the free writing exercise. While dictionary use was not forbidden, students were encouraged to write freely and not worry about spelling or grammar errors in their free writing; the use of machine translation was prohibited. At the end of 10 minutes, students were

instructed to count the number of words they had written and note that number at the bottom of the worksheet before submitting it to the researcher. The researchers did not double-check the WPM counts by the students. Participants each completed 20 to 24 free writing activities.

The data included in this study was collected in 2018 (35 participants), 2019 (19 participants), and 2023 (27 participants). The data sets for the years 2020 through 2022 were not complete enough to include, nor did they meet the statistical requirements of normality, that is, the data did not follow a rough bell-shaped distribution, so those cohorts were excluded.

Data Analysis

Due to student absences and other reasons, the data set was not 100% complete for all students across all iterations of the free writing practice in the collection years of 2018, 2019, and 2023. Therefore, all of the data sets were cleaned before analysis using Multiple Imputation (Rubin, 1987) to estimate missing values. The focus of the data analysis centered on tracking changes in the number of words written over time, clustering students into performance groups, and using regression analysis to assess longitudinal progress and identify areas where trends emerged in the longitudinal data. The cluster analysis of the data was conducted using Python (Python Software Foundation, 2023). In addition, one-way Analysis of Variance (ANOVA) was conducted to compare group means across cohorts and examine statistical significance in writing performance changes (Virtanen et al., 2020).

With regard to the normality and homogeneity of data set checks, the 2018 Spring term data did not meet the normality assumption ($p = 0.0229$), whereas the Fall term was normally distributed. The assumption of homogeneity of variances was not violated ($p = 0.7169$). The 2019 term was normally distributed with one exception, so it is considered to be normal for purposes of data analysis ($p = 0.4322$). The 2023 data showed no statistically significant differences between Spring and Fall terms and was considered to be normal ($p = 0.799$) ($p > .05$). In sum, the 2018 data was not completely normal for paired t-test of students' first writing and final writing data, which suggested variances among the students—leading to some significant findings that were not consistent from term to term. The 2019 data was mostly normal but provided no significant findings, as was the 2023 data normal with no significant findings. Due to a lack of consistent patterns and normality violations in the findings of the first versus final writing performance-based paired t-test analysis, the authors explored analyzing the data using

cluster analysis (Driver & Kroeber, 1932) to identify variability among participants, and regression analysis (as recommended by Allen (1997)) to identify trends that appeared over time in a longitudinal analysis of the participants' performance regarding WPM produced.

Results

Because statistically significant findings from the paired t-tests were inconsistent across cohorts and not generalizable, they are not presented here in detail. The ANOVA results for comparing the three cohorts (2018, 2019, and 2023) are as follows:

- F-statistic: 1.05
- P-value: 0.3538

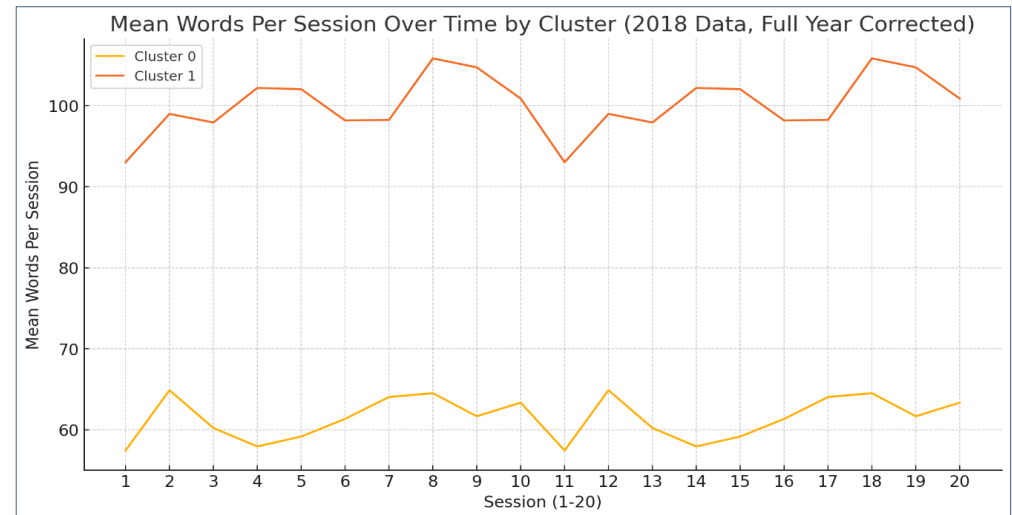
Since the p-value is greater than 0.05, there is no statistically significant difference among the cohorts in terms of the mean words per session. Overall, this suggests that performance trends across the years are not significantly different, e.g., the sample populations in each school year had approximately the same EFL free writing performance.

The two types of statistical analysis which produced usable findings—cluster analysis and regression analysis—will be expounded on below. This study focused on methods that revealed usable patterns, including the Elbow Method (Thorndike, 1953) and subsequent clustering. In considering the WPM performance in the figures below, it would be helpful to remember that each of the topic choices given were provided for two weeks' worth of free writing through the first 12 iterations and then repeated from iteration 13 to 24.

Cluster Analysis

The cluster analysis (K-means) showed that in the 2018 data, two distinct student clusters could be identified as significant improvement and moderate improvement. Significant improvement was considered to be high performers who consistently improved and maintained high performance levels (Cluster 1 in Figure 1). Moderate improvement was limited improvement or no decrease in output, ending with a slightly higher output (Cluster 0 in Figure 1). The clustering indicates variability among students, with some showing significant progress and others improving at a more moderate pace. Figure 1 shows the clustering of the 2018 data.

Figure 1
Clustering of 2018 participant data based on average WPM produced



In both 2019 and 2023, three clusters emerged: low, moderate, and high WPM producers. The 2023 data showed greater separation among clusters than 2018, particularly in identifying struggling students. Cluster analysis (K-means) of the 2019 and 2023 data set revealed 3 clusters categorized as:

- Cluster 0: Struggling students who experienced minimal improvement in performance over time.
- Cluster 1: Moderate performers with a slight trend of improvement throughout the term.
- Cluster 2: High performers who consistently improved and maintained high performance levels.

These clusters were identified based on visual trends in students' WPM trends across sessions, as illustrated in Figures 2 and 3.

Figure 2
Clustering of 2019 participant data based on average WPM produced

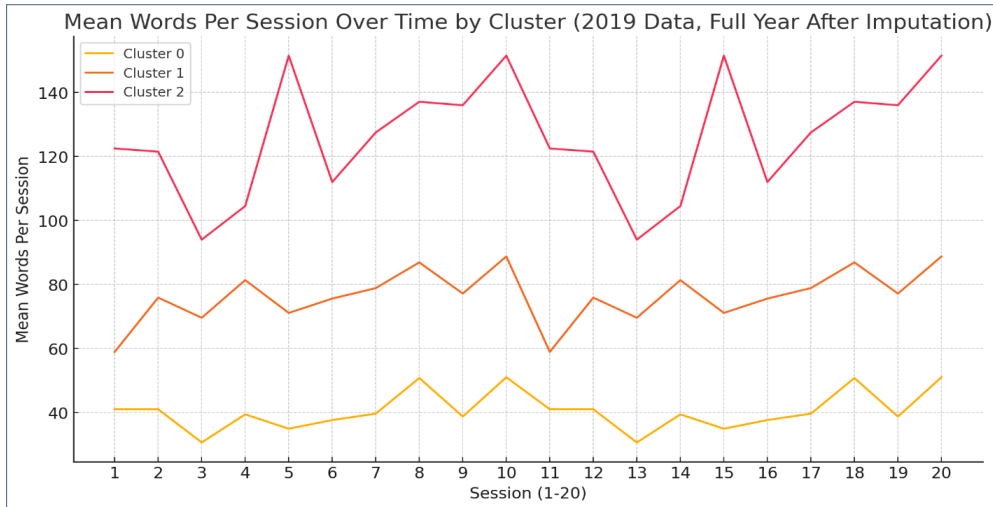
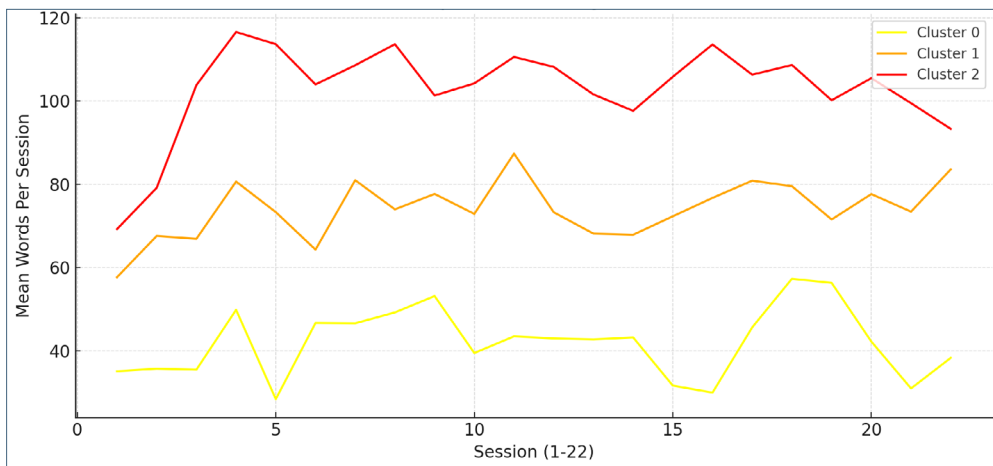


Figure 3
Clustering of 2023 participant data based on average WPM produced



Regression Analysis

Regression analysis was performed at the cohort level on the three years of data sets to identify trends that appeared over time in a longitudinal analysis of the participants' performance. The analysis looked at how the participants' performance developed and looked at what factors, such as the given free writing topic sets, may have influenced those changes. As the regression trend lines across all three cohorts followed a similar shape, only the summary statistics are provided in Table 1.

Table 1
Regression Analysis Results

	2018	2019	2023
Start (Session 1)	71.16 words	58.50 words	63.60 words
End (Session 20)	77.42 words	84.11 words	71.54 words
Actual Change	+6.26 words	+25.61 words	+7.94 words
Slope	0.14	0.50	0.30
Intercept	74.89	66.15	67.61
R-squared	0.11	0.16	0.14
P-value*	0.1475	0.0846	0.1019

Note. * P-values were not statistically significant; $p \geq 0.05$.

Regression analyses for all three cohorts revealed slight upward trends in WPM, but none of these changes reached statistical significance (see Table 1). While Topic Sets 3 and 6 were associated with slightly higher average WPM, this pattern was inconsistent and cannot be confidently linked to topic influence without further qualitative data.

Discussion

Because statistically significant results were inconsistent and not generalizable across cohorts, they are not further discussed here. Similar to what the authors found in previous research (Forsythe & MacWhinnie, 2023), although small increases in WPM could be found, they do not exist across all variables or cohorts so they are not reliable and cannot be generalized across all free writing activities.

No studies were found to have conducted statistical analysis on the WPM produced in free writing exercises done by Japanese university students; previous research only compared quantitative WPM data to observe general changes. Therefore, a discussion of how this study's findings align with existing research cannot be had. Azizi (2015) reported quantitative data revealing increases in WPM produced, but no analysis was performed to establish the statistical significance of those gains. Baba and Nitta (2014) performed one-way ANOVA analysis to determine the variance of their two participants' WPM produced, but the statistical significance of those variances was not explored, and the data analysis methods differed from the current study, so it cannot be included in a discussion of the current study's findings.

Regarding the participants' improvement in English writing over time, the 2019 and 2023 cohort data exhibited no statistically significant improvements, instead demonstrating more consistent writing performances throughout the year. Insights from the cluster analysis found that the 2018 data effectively divided into two distinct student clusters, whereas 2019 and 2023 revealed three clusters, thereby indicating a broader range of student performance—including a group that had minimal improvement over time. This would align with Azizi's (2015) findings. However, students who produced less than 10 WPM showed almost no longitudinal growth across all three years' data sets. This supports Broekema's (2020) statement that lower-level students need more support in order to have more successful improvement in free writing production. Regression analyses of all three years' data were positive but not statistically significant. This fits with Baba and Nitta (2014) and Herder and King (2012) but conflicts with Muller's (2014b) study that showed no improvement in WPM produced.

The key finding of analyzing WPM production in free writing is that teachers may see linear increases by looking at data in aggregate, but those increases, while appearing to show improvement, are not statistically significant. Therefore, more statistical analyses of WPM data would provide a clearer picture of whether free writing produces statistically significant improvement in EFL writing ability.

Looking at the effects of the writing topics on the participants' performance, the 2018 topic performance seemed to remain steady throughout the school year. 2019 topic performance was interesting in that after Topic Set 1, production declined steadily with Topic Sets 4 & 5 resulting in much fewer words written. While conclusions cannot be drawn from the quantitative data to explain this continual decline, the reduction in WPM could reflect reduced motivation, topic fatigue, or unrelated variables not captured in this study. In 2023, topic performance was a notable factor, especially in Topic Set 6 which was associated with higher WPM averages. The topic performance data shown

in this study align with Dickenson (2014), Ferreira (2013), Forsythe and MacWhinnie (2024), Leblanc and Fujieda (2012), Ottoson and Crane (2017), and Shiobara's (2014) findings that the topics can have an effect on the participants writing fluency, but it seems that the students' ability to select the free writing topics has little influence on how well they perform, as all Topic Sets allowed for student selection.

Implications for Instruction

The identification of distinct performance clusters in 2019 and 2023, although not statistically validated beyond the clustering algorithm, suggests a need for more specific, targeted support for struggling students (as recommended by Broekema, 2020). Analysis of 2018, 2019 and 2023 data revealed different patterns in student progression. The 2018 cohort showed a positive trend in WPM over time, though results were not generalizable, whereas 2019 and 2023 data reflected stable performance throughout the year with clearer differentiation among participant clusters. This study's data shows there are 2 to 3 clusters of student types in performing free writing in EFL. These patterns could inform differentiated instruction aimed at supporting each performance group. These findings emphasize the need for individual support and strategic topic selection to boost performance and enhance writing outcomes for diverse groups of learners. Future instructional strategies could include targeted interventions for struggling students, along with a focus on high-engagement topics to maximize student interest and growth potential.

Considering the effect that the free writing topics may have had, certain topics may have influenced performance: Topic Set 3 led to higher WPM counts produced, whereas Topic Set 2 seemed to reduce performance. Descriptive patterns in the data suggest that some topics—such as Topic Set 6—were associated with higher WPM averages. Topics perceived as relevant or accessible, such as personal experiences or current events, may support increased writing output.

Existing research provides the following suggestions about making free writing as beneficial as possible: Broekema (2020) suggests doing learner training at the beginning to explain free writing goals and processes with a focus on fluency over accuracy. Dickinson (2014), Leblanc and Fujieda (2012), Ottoson and Crane (2017) as well as Shiobara (2014) all recommended allowing students the freedom to choose the writing topic, but Piper (2015) also said that instructors should give possible topics to choose from if students have no idea what to write about. The findings of this study align with these suggestions.

Although this study and others do not provide statistically significant evidence that free writing improves fluency (as measured by WPM), no negative effects were observed. Therefore, considering its low resource demands and potential motivational benefits, free writing remains a reasonable classroom activity.

Conclusion

The key finding of analyzing WPM production in free writing is that teachers may see linear increases by looking at data in aggregate, but those increases, while appearing to show improvement, are not statistically significant. Additionally, patterns in subgroup performance may have instructional relevance.

Free writing is a commonly used activity in Japanese university EFL classrooms (Baba & Nitta, 2010, 2014; Forsythe & MacWhinnie, 2023, 2024; Muller, 2014b; Rivers, 2007; Shiobara, 2014) and students' performance as measured in words per minute (WPM) produced varies based on topics to be written about, student experience, and other factors. This study statistically analyzed three years' worth of Japanese university students' WPM data to determine whether free writing results in statistically significant improvements in the amount of language produced through free writing practice. Participants' WPM data in cohorts from 2018, 2019, and 2023 were analyzed using both cluster and regression analysis to determine whether statistically significant trends existed to support the use of free writing activities. Cluster analysis revealed two or three distinct groups of learners across cohorts: high performers, moderate performers, and struggling performers. Although these groupings were not statistically validated and only observed patterns, this suggests the potential for differentiated instruction aimed at improving fluency among lower-performing students.

The regression analysis found production variation across topics in all three cohorts, although overall improvements were not statistically significant. While this study did not find statistically significant gains in writing fluency, no negative effects of free writing were observed in this or prior studies. Therefore, it may still be a valuable low-risk classroom activity, especially when implemented with targeted support (Broekema, 2020) so that all students can benefit from free writing practice in English.

Bio Data

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Appendix

English Composition IA Class Free Writing Topics

There are six sets of free writing topics. Each set was used twice (once per week for two consecutive weeks) for a total of 12 free writing sessions.

- Set 1: Hobbies, favorite game / sport, favorite movie
- Set 2: School days, clubs, part-time jobs, favorite holiday
- Set 3: Foreign country to visit, studying at university, favorite food
- Set 4: Where you want to live, favorite book, school trips
- Set 5: Weekend activities, favorite TV show, pets, animals
- Set 6: Summer vacation, North Korea problem, celebrities