A Longitudinal Study on Japanese Learners' Written Complexity, Accuracy, and Fluency

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Most traditional EFL writing classes in Japan, have over-emphasized data collection of exam scores, completion of homework or e-learning modules (Harwood, 2019; Iwasaki et al., 2019). Little research has been conducted about improvement in students' writing over a period of time (Hokamura's (2018); thus, this paper reports on the results of changes in Japanese EFL students' writing complexity, accuracy, and fluency (CAF) in a span of one academic school year. Research questions focused on differences in grammatical errors and syntactic complexity between a control group, wherein students wrote three essays, and a treatment group, wherein students wrote eight papers over an academic semester. Specifically, the study aimed to find out if there were significant improvements in grammar accuracy and syntactic complexity between the first and second written drafts as well as, if there was any significant difference with the use of self-editing and grammar online checkers between the two groups. A significant difference was found between the groups in regard to syntactic complexity, and fluency, which oscillated with clauses per T-unit, increased 3.2% on average. Furthermore, grammatical errors decreased over the year for the treatment group, and improvements in syntactic complexity were found to be significant for both groups. The use of online grammar checkers was confirmed to result in fewer errors. Overall, the study indicates that EFL writing (CAF) is impacted by instruction and that more attention is warranted regarding EFL writing classes.

従来のEFLライティングの授業では、ほとんどの場合、試験の点数や宿題の完成度、Eラーニングのモジュールなどのデータ収集が過度に重視されてきた。一定期間にわたる生徒のライティング向上に関する研究は、ほとんど行われていない。本報告は、1年間における日本語EFL生徒のライティングの複雑さ、正確さ、流暢さ（CAF）の変化に関する研究である。研究課題は、対照群（1学期間に3本の小論文を書いた生徒）と処理群（8本の小論文を書いた生徒）の文法的誤りと構文の複雑さの違いに焦点を当てた。具体的には、第1稿と第2稿で文法の正確さと構文の複雑さに有意な改善が見られたかどうか、また、自己校正と文法オンラインチェッカーの使用について両群の間に有意な差が見られるかどうかを調べることを目的とした。構文の複雑さに関しては、両群間に有意差が認められ、流暢さはTユニットあたりの節数により揺れが見られたが、平均3.2%増加した。また、処理群では、文法的ミスは1年間で減少した。構文の複雑さについては、対照群、処理群ともに、有意に向上した。また、オンライン文法チェッカーの使用により、間違いが少なくなることが確認された。全般的に、本研究は、EFLライティング（CAF）が指導による影響を受けており、EFLライティングの授業に関して更なる注意を払う必要があることを示している。

Keywords: writing; syntactic complexity; accuracy; fluency; editing

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In current classrooms, quiz and exam scores, completed homework assignments or e-learning modules are often the focus of a curriculum causing many EFL educators to mistake the 'forest for the trees' in second language acquisition (SLA). The forest represents the students' total communication ability and interaction performance, while the trees represent these various goals or homework assignments. In EFL writing classes, often the focus has been on 'tree of accuracy' instead of syntactic complexity, and fluency (number of words written in a specific time). It can be argued that while accuracy has been given a relatively great deal of attention in the classroom, syntactic complexity, and fluency in writing are frequently not fully addressed due to pedagogical practices and norms.

Most EFL grammar materials infrequently address syntax and syntactic complexity, with students familiarizing themselves with simple, compound, and compound-complex sentence patterns while rarely being forced to explore and develop others; Ortega (2003) discusses how English as a Foreign Language (EFL) learners often exhibit limited syntactic complexity in their writing. This limitation is attributed to instructional materials and practices that emphasize simpler sentence structures, such as simple and compound sentences. This, of course, can result in students simply not having sufficient opportunities to engage with more complex syntactic forms. Fluency, the last construct in CAF, is rarely considered and evaluated in the classroom, except through timed writings; yet, the need for students to do research like, data gathering, taking notes, and write a research paper in a timely fashion cannot be overstated as research facilities, and governmental entities will all require writers to meet deadlines.

This paper is partly based on Hokamura's (2018) longitudinal research into the development tendencies of students' CAF focusing on the interconnection between complexity, accuracy and fluency in students' writing and how they improve over time. Hokamura found major peaks in learners' CAF growth, and how CAF components interact over

time. Her data showed that the participants' CAF altered over time as expected by essential properties of dynamic systems and that the three CAF categories were rarely positively associated with one another.

The relevance of performing longitudinal studies of individual learners is highlighted in this study. While Hokamura's study (2018) was limited to two students; this study had ten participants from Hiroshima University who wrote from three to ten essays over the course of a year. Furthermore, the aim was to better understand the dynamics of the writing process and to better understand the role of editing and proofing which was not previously studied. These results can help to guide educators to better recognize the complexity of students' writing.

Syntactic Complexity

Syntactic complexity refers to correctness, accuracy and fluency (CAF) components, which are classified in several ways, with complexity being defined as " progressively more intricate language and a wider spectrum of syntactic patterns" (Foster & Skehan, 1996, p. 303). The quality of L2 writing (as judged by raters) is influenced by both writing and language skills; however, only a few areas of syntactic complexity have been studied in relation to L2 writing quality. Foster and Skehan used overall length measurements, with the mean length of T-unit (MLTU) being the most common, followed by mean length of sentence (MLS), and mean length of clause (MLC).

Syntactic complexity does not always evolve in a linear fashion as measured by the subordination ratio but can extend in other ways as well, such as through phrasal and clausal complexification Kuiken and Vedder (2019). Yuan and Ellis (2003, p. 2) agreed, stating "Measures of complexity are frequently dependent on the amount to which subordination is obvious;" for example, per T-unit or per c-unit, the number of clauses. In some circumstances, type-tokens have been used to assess lexical difficulty, but clausal subordination (finite) has also piqued interest, with clauses per T-unit (C/TU) being a common metric. The findings from these tests in the past are mixed, (Ortega, 2003): in some cases, they were found significant (e.g., Homburg, 1984; Kameen, 1979) and in others, non-significant (e.g., Larsen-Freeman & Strom, 1977; Nihalani, 1981).

Accuracy

Interlanguage error correction has been a long pedagogical focus for educators (Wolfe-Quintero et al., 1998), with applied linguistics distinguishing between two types of errors: performance errors (made by rushed or exhausted learners) and competence errors (mistakes caused by insufficient learning). Gefen (1979) later referred to performance errors as mistakes while Selinker (1972) was the first to identify the learner's "interlanguage" and the problem of fossilization, emphasizing the influence of the learner's native language, interlanguage, and target language on the L2.

Similarly, Richards (1971) identified four major types or causes of intralingual (developmental) errors: overgeneralization, ignorance of rule constraints, insufficient application of rules, and hypothesized erroneous notions. Richards (1974) further recognized seven sources of errors: (a) interference, (b) overgeneralization, (c) performance errors, (d) markers of transitional competence, (e) communication and assimilation methods, and (f) successions of approximative systems, and (g) universal hierarchy of difficulty. There can be a great deal of interlingual transfer from the native language in the early stages of learning a second language. In addition, Shumann and Stenson (1974) suggested reasons for errors as: insufficient target grammar acquisition, limits of the learning/teaching context, and those caused by common language performance obstacles such as inter- and intra-lingual issues.

Fluency

Fluency is defined as the number of words or structural units a writer can include in their writing in a given length of time (Wolfe-Quintero et al., 1998, p. 14). Individuals with fluent writing skills, (Chenoweth & Hayes, 2001; Kaufer, Hayes, & Flower, 1986), produce more texts in less time although the rate/time method is frequently chastised for ignoring essential factors like lexical difficulty and readability. It has been pointed out that writers aim to write as many words as possible in the time provided, regardless of word difference or density, or the text's comprehensibility The rate/time method is frequently chastised for ignoring essential factors like lexical difficulty and readability. A common criticism has been that writers aim to generate as many words as possible in the time provided, regardless of the difference or density of the words used or the text's comprehensibility. One of the key characteristics of fluid writing, according to both experts, is the ability to produce a range of word combinations and sentence patterns. Fluent writing can be defined as the process of writing the greatest number of language units in the shortest amount of time while also paying attention to accuracy, the coherent and consistent structuring of ideas within the text, and the complex use of words and sentenc-

es, based on the foregoing information. The construction of a definition that encompasses all fluent writing capabilities is closely tied to the means to measure these abilities. The ability to write a high-quality text with a considerable number of words in a short amount of time has been loosely defined as the rate/time approach to fluent writing.

Rationale

To comprehend the overall change in student L2 compositions over an academic year, it is necessary to first identify and comprehend why individual factors such as complexity, fluency, and correctness may peak or show minimal improvement. It is not clear how the three CAF components interact and evolve over time. Because the three dimensions must be evaluated together to understand their interactions and how they influence one another, this study will address this gap.

One of the most important characteristics of dynamic systems is their interconnection. While numerous studies are being undertaken in the field of education, it is critical to know how effective first-year English language classes are at private and public colleges in Japan. Because such programs cost a great deal and need a lot of oversight, planning, and evaluation in terms of grammatical accuracy and TOEIC scores, little is known about Japanese students' real skills in L2 composition and how they progress over a school year.

Research Questions

The research queries are as follows:

1. Is there a significant difference in syntactic complexity and grammatical accuracy between the control group and treatment group?
2. For the treatment group, do scores for syntactic complexity and fluency significantly increase over the year? Similarly, do grammatical errors decrease over the year?
3. Is there a significant improvement between the first drafts and second drafts for syntactic complexity for both the control and treatment groups?
4. In comparing the first and second drafts of both the control and treatment groups, is there any significant difference in grammatical accuracy?
5. How do self-editing and use of online grammar checkers affect differences, if any, in the grammatical accuracy (frequency of errors) between the two groups

Participants

Ten Japanese students participating in a writing course at Hiroshima University, ages 20 to 22, joined the study University permission was obtained in April and May, following national university guidelines. COVID-related procedures strictly impacted participation.

Procedures

Eight students joined the control group that submitted three papers for the academic year, whereas two students joined the treatment group that submitted eight essays each month. The intent was to determine if more writing practice will yield better results. In both groups, students in both groups were further divided into users of self-editing or online grammar checks to revise their second drafts.

Data Collection: Essays

Data collection was conducted from May 2020 to January of 2021; a total of 35 essays were collected and examined. The background and goals for each theme were provided to instructors who then worked theses assignments into their own curriculum. For example, a control group of eight students submitted one paper per month for a total of three months whereas the treatment group submitted eight papers (one paper per month) for a total of eight months. 15 minutes were given to revise each paper.

Data Analysis

Since the overall framework of the study is based on CAF, a syntactic complexity analyzer (Lu, 2010) was used to analyze nine structures and 14 syntactic complexity indices of the text. Grammatical accuracy focused on error-free clause ratios (EFCR), clauses with errors / 100 words. Fluency was measured by word count for both drafts. Statistical analyses were conducted comparing the papers gathered from the classes. As the sample size is limited, non-parametric procedures were utilized, relying on t-tests and computation results gather from a L2 syntactic complexity analyzer (L2SCA) (Lu, 2010).

Results

For the first research question, there was a significant difference between the groups; a two-tailed t-test at 0.05 alpha showed syntactic complexity in the first draft being (M = 9.96, SD = 14), $t(-1.79) = 2.144$, $p = 0.09$ and in the second draft, (M = 13.3, SD = 14), $t(1.80) = 2.144$, $p = 0.09$.or accuracy, results showed, (M = 7.77, SD = 8), $t(-0.107) = 2.306$, $p =$

0.016) and (M = 12.87, SD = 8), $t(-1.09) = 2.306$, $p = 0.305$), for the first and second drafts, respectively. See Table 1 for the raw data for both groups. Results indicate that more EFL instruction does impact writing outcomes when it comes to syntactic complexity and in improving accuracy.

The results show that complexity increased over time from paper 1 to paper 8 for the treatment group, and more complexity was noted in the edited drafts. Accuracy scores, however, showed no improvement, and seemed to be related to the topic, as observed in a marked decline from papers 1 and 6. Scores for syntactic complexity and fluency significantly increased over the year; fluency did increase over time as well but with oscillations. While C/T (clauses per T-unit) increased 3.2% on average, and from one paper to the next, a regressive slope of 0.0008 was noted. Furthermore, CP/T (Coordinate phrase per T-unit) did not change significantly, and

Table 1

Raw Data for Both Groups (Control and Treatment)

Paper	Indicator	First draft		Second draft	
		Control group	Treatment	Control group	Treatment
Syntactic complexity					
Paper 1	Complex T-unit	1.42	1.54	1.52	1.42
	Clauses	28.33	50.00	51.00	30.00
	Coordinate phrase per T-unit	0.49	0.33	0.30	0.48
	Mean length for T-unit	13.90	12.80	12.85	13.90
	T-unit per sentence	1.15	1.18	1.20	1.16
Paper 6	Complex T-unit	1.63	1.84	1.84	1.65
	Clauses	28.00	39.50	39.50	28.50
	Coordinate phrase per T-unit	0.35	0.42	0.42	0.34
	Mean length for T-unit	16.53	17.30	17.50	16.88
	T-unit per sentence	1.10	1.16	1.16	1.11
Paper 8	Complex T-unit	1.72	1.84	1.92	1.83
	Clauses	37.50	52.00	52.50	37.00
	Coordinate phrase per T-unit	0.43	0.45	0.47	0.41
	Mean length for T-unit	15.62	15.55	16.10	15.82
	T-unit per sentence	1.28	1.33	1.29	1.30
Accuracy					
Paper 1	Error-free clause (EFCT)	0.57	0.43	0.69	0.72
	EFCT (total)	15.50	16.00	36.00	37.50
	Errors / 100 ratio	5.09	4.41	5.95	5.38
Paper 6	Error-free clause (EFCT)	0.42	0.44	0.58	0.64
	EFCT (total)	12.33	13.17	23.00	25.50
	Errors / 100 ratio	7.75	7.10	5.80	5.05
Paper 8	Error-free clause (EFCT)	0.58	0.63	0.65	0.66
	EFCT (total)	21.67	23.33	38.00	38.50
	Errors / 100 ratio	6.10	4.79	5.21	5.31

Note: ECFR refers to error-free clause ratio whereas EFCT denotes error-free clause total.

a regression slope showed a decline, while mean length of T-unit (mean length for T-unit) significantly increased. For T-unit per sentence, a significant increase was observed with a change of 1.28% in the slope. Table 2 shows the slope and CAGR, (compound annual growth rate); the raw data are shown in Table 3, and a graphic displaying the changes in syntactic complexity and fluency over time is shown in Figure 1.

Figure 1

Changes in Syntactic Complexity and Fluency Over Time

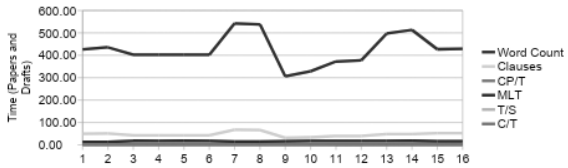

Table 2

Results for Fluency and Syntactic Complexity Over the Academic Year

Factors	Variables	Slope	CAGR
Fluency	Word count	1.1728	0.08%
Syntactical complexity	Complex T-unit	0.0008	3.21%
	Clauses	–0.0147	0.70%
	Coordinate phrase per T-unit	0.0015	5.41%
	Mean length for T-unit	0.1280	3.33%
	T-unit per sentence	0.0016	1.28%

Table 3

Fluency and Syntactic Complexity Raw Data for All Papers

	Fluency		Syntactic complexity			
	Word count	C/T	Clauses	CP/T	MLT	T/S
Paper 1	426.00	1.54	50.00	0.33	12.8	1.18
	435.50	1.52	51.00	0.30	12.8	1.20
Paper 2	403.00	2.02	42.50	0.53	18.10	1.13
	402.00	1.99	42.00	0.53	18.00	1.13
Paper 3	403.00	2.02	42.50	0.53	18.10	1.13
	402.00	1.99	42.00	0.53	18.00	1.13
Paper 4	542.50	1.82	67.50	0.26	14.45	1.25
	538.00	1.77	66.00	0.24	14.30	1.25
Paper 5	306.00	1.68	31.00	0.42	16.55	1.11
	328.50	1.78	33.50	0.47	17.35	1.11
Paper 6	372.50	1.84	39.50	0.42	17.30	1.16
	377.50	1.84	39.50	0.42	17.50	1.16
Paper 7	497.00	1.67	47.50	0.41	17.85	0.80
	513.50	1.65	48.00	0.39	18.15	1.20
Paper 8	427.00	1.84	52.00	0.45	15.55	1.33
	428.50	1.92	52.50	0.47	16.10	1.29

Regarding the third research question, grammatical errors in treatment group decreased over the year, as did both EFCR and EFCT(Total) and Errors / 100 ratio. An outlier was observed in the second draft of Paper 7 which significantly changed the slope of regression). A slope with coefficient of –0.003 was obtained by removing the outlier, suggesting that this indicator also decreased over time. See Figure 2 for graphic data relating to changes in errors over time, and Table 4 for raw data.

Figure 2

Changes in Errors Over the Academic Year

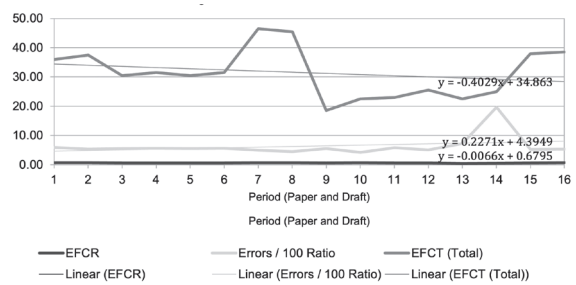

Table 4

Raw Data for Accuracy Variables for All Essays

	EFCR	EFCT (total)	Errors / 100 ratio
Paper 1	0.69	36.00	5.95
	0.72	37.50	5.38
Paper 2	0.60	30.50	5.56
	0.65	31.50	5.61
Paper 3	0.60	30.50	5.56
	0.65	31.50	6.61
Paper 4	0.69	46.50	5.01
	0.69	45.50	4.47
Paper 5	0.57	18.50	5.58
	0.67	22.50	4.19
Paper 6	0.58	23.00	5.80
	0.64	25.50	5.05
Paper 7	0.45	22.50	7.25
	0.51	25.00	19.70
Paper 8	0.65	38.00	5.21
	0.66	38.50	5.31

As for the fourth research question, significant changes between the first and second drafts were observed indicating improvement in syntactic complexity for both the control and treatment groups. Results of t-test analysis d are as follows: differences for the control group between the first and second drafts (M = 9.96, SD = 4.0), $t(-1.47) = 2.776$, $p = 0.2144$), for the treatment group (M = 13.2, SD = 4.00), $t(-1.91) = 2.776$, $p = 0.1281$), and (M = 11.51, SD = 4), $t(-1.64) = 2.776$, $p = 0.175$); see table 5 for descriptive data.

Table 5

Descriptive Data for First and Second Essays

Variables	First essay	Second essay	% change
Control group			
Complex T-unit	1.59	1.63	2.80
Clauses	31.28	31.83	1.78
Coordinate phrase per T-unit	0.42	0.41	–4.06
Mean length for T-unit	15.35	15.53	1.18
T-unit per sentence	1.18	1.19	1.18
Treatment group			
Complex T-unit	1.80	1.81	0.21
Clauses	46.56	46.81	0.54
Coordinate phrase per T-unit	0.42	0.42	0.00
Mean length for T-unit	16.34	16.53	1.19
T-unit per sentence	1.13	1.18	4.13
Both groups			
Complex T-unit	1.69	1.71	1.50
Clauses	38.47	38.88	1.07
Coordinate phrase per T-unit	0.42	0.41	-2.17
Mean length for T-unit	15.81	16.00	1.18
T-unit per sentence	1.16	1.19	2.54

The data for the fifth research question showed significant changes relating to the improvement in grammatical accuracy between the first and second drafts for both groups, as can be seen in Table 6, (specifically a difference in errors / 100 ratio, with the EFCT totals).

Table 6

Changes Related to Grammatical Accuracy

Indicator	First	Second	Change
Control group			
Error-free clause (ratio)	0.52	0.50	–4.24%
EFCT (total)	16.50	17.50	6.06%
Errors / 100 ratio	6.31	5.43	–3.96%
Treatment group			
Error-free clause (ratio)	0.60	0.65	7.05%
EFCT (total)	30.69	32.19	4.89%
Errors / 100 ratio	5.74	6.91	20.46%
Both groups			
Error-free clause (ratio)	0.56	0.57	1.47%
EFCT (total)	23.18	24.41	5.33%
Errors / 100 ratio	6.04	6.13	1.42%

A t-test revealed differences between the first and second drafts for the control group (M = 7.77, SD = 2.0), $t(-0.05) = 4.320$, $p = 0.9584$), (M = 12.3, SD = 2.00), $t(-2.05) = 4.3027$, $p = 0.1768$) for the treatment group, and (M = 9.92, SD = 2), $t(-1.11) = 4.30$, $p = 0.3803$) for the control group. Regarding the final research goal, a significant difference in grammatical accuracy was observed between those who self-edited and those who used an online grammar checker; (M = 7.68, SD = 15.0), $t(1.22) = 2.1314$, $p = 0.2383$) (see Table 7).

Table 7

Difference in GA Between Self-Editing and OGC

Paper	Draft	Self-editing	Online grammar checker
Paper 1	First	6.65	3.96
	Second	5.64	3.67
Paper 2	First	10.20	0.92
	Second	10.30	0.92
Paper 3	First	10.20	0.92
	Second	10.30	0.92
Paper 4	First	5.14	4.87
	Second	4.50	4.43
Paper 5	First	8.80	2.35
	Second	6.90	1.47
Paper 6	First	7.38	7.15
	Second	6.65	6.52
Paper 7	First	9.80	4.70
	Second	7.40	32.00
Paper 8	First	6.63	5.13
	Second	6.45	3.39

Discussion

These results indicate that more writing practice (as was the case with the treatment group) does help improve writing; however, with regard to fluency and syntactic complexity results were negligible, with fluency increasing from a mean of 319.38 in paper 1 to 351 in paper 8, while MLT for complexity, went from 13.63 in paper 1 to 15.60 and C/T increased from 1.16 to 1.30.

Results also suggest that teachers need to let students know how they are improving with each paper and focusing on issues relating to syntax during the course of instruction . While there was improvement noted from the first drafts to the second, particularly with those who used online grammar checkers, the area of editing and proofing remains a skill that teachers could place more emphasis on.

Conclusion

These results do show the importance of doing longitudinal studies and examining the importance of technology as it relates to the skill of writing. More work needs to be done regarding the effectiveness of online grammar checkers as it relates to grammatical forms and to syntactic complexity. The results also indicate that both fluency and syntax could be given more priority in the classroom.

Further research needs to be conducted with a more generalized population drawn throughout Japanese universities.There is a need for more studies to show how varying levels of proficiency could influence CAF change over an academic year. These can provide insights into issues like how differences in proficiency levels affect writing output, and the role of accuracy therein. In addition, it is important to compare CAF data from different EFL backgrounds. Such findings can possibly spur further investigations into the educational pedagogy and

teaching methods in these countries and institutions. As this study was limited in scope, research aims for other studies should include if there are possible gender differences in writing regarding CAF, if similar or varied topics significantly impact results, and to see if extending the time from 15 minutes for editing and proofing would signifcantly change the overall CAF of each paper.

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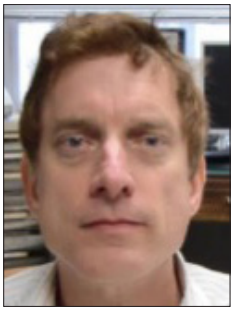

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