Identifying Key Grammatical Errors of Japanese English as a Foreign Language Learners in a Learner Corpus: Toward Focused Grammar Instruction with Data-Driven Learning

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The number of studies on data-driven learning (DDL) has increased in recent years, and DDL's overall effectiveness as an L2 (second language) teaching methodology has been reported to be high. However, the degree of its effectiveness in grammar instruction, particularly for the goal of correcting errors in L2 writing, is still unclear. To provide guidelines for focused grammar instruction with DDL in the Japanese classroom setting, we aimed to identify the typical grammatical errors made by Japanese learners in the Cambridge Learner Corpus First Certificate in English (CLC FCE) dataset. The results revealed that three error types (nouns, articles, and prepositions) should be addressed in DDL grammar instruction for Japanese English as a foreign language (EFL) learners. In light of the findings, pedagogical implications and suggestions for future DDL research and practice are discussed.

Keywords: Learner Corpus, Error Analysis, Construction Grammar, Data-Driven Learning, Grammar Instruction

1. Introduction

In recent years, corpora have become an integral part of the research of second language acquisition (SLA) and L2 (second language) learning and teaching. Theoretically, as Gries (in press) argued, corpora can provide researchers with particularly valuable information about formulaic usage patterns (e.g., Polio & Yoon, 2021) from the viewpoint of usage-based theory (Ellis et al., 2016; Murakami & Ellis, 2022). Usage-based theory, asserting that language structure is formed through exposure and thus influenced by frequency, has gained prominence in SLA research. Though corpora have always existed, this surge in popularity of the usage-based theory has spurred an increase in their application within the field, especially for language learning and teaching. Practically, the use of corpora has had a significant effect on the development of materials (e.g., dictionaries, usage manuals, grammar books, and course books) and tests (Reppen, 2010; Taylor & Barker, 2008; Tomlinson, 2013). Thus, the utilization of corpora is increasingly recognized as a significant contributor to the field's ongoing advancements.

Römer (2011) proposed that pedagogical corpus applications might be direct (i.e., hands-on for learners and teachers) or indirect (i.e., hands-on for researchers and materials writers). One of the direct corpus applications, in which learners gain hands-on experience utilizing a corpus for learning purposes, is referred to as data-driven learning (DDL) (Johns, 1991). The past few decades have seen an exponential increase in the number of DDL studies (Boulton & Vyatkina, 2021), to the extent that

these studies' quantitative results were synthesized in meta-analyses (Boulton & Cobb, 2017; H. Lee et al., 2019; Mizumoto & Chujo, 2015) reporting the overall positive results of DDL use.

DDL has been primarily found to be effective for learning lexico-grammatical items, and it could be used, amongst other things, to teach skills or language aspects such as error correction, revision in writing, or explicit grammar instruction. In studies where DDL is employed to rectify grammatical writing errors, the choice of grammar items typically hinges on the judgment of the researchers, meaning that items are often pre-selected. According to Collins and Ruivivar (2021), an optimal approach would involve tailoring the selection of target items to match learners' specific context. This personalization can potentially maximize the effectiveness of DDL in grammar instruction.

This perspective gains further support when considering the strong influence of learners' first language (L1) on their acquisition of English grammar, their L2. Appel and Szeib (2018) argue that a learner's L1 considerably shapes their grasp of L2 grammar. Therefore, a more tailored approach to item selection, considering this L1 influence, could prove beneficial in language acquisition research.

In pursuit of this goal, this study utilized a learner corpus tagged with errors, specifically examining the characteristic grammatical mistakes made by Japanese students learning English as a foreign language (EFL). The aim was to provide foundational knowledge to guide future research and practical applications of DDL.

2. Literature Review

DDL is a methodology that applies corpus linguistics methods and techniques in the teaching and learning of a second or foreign language (Boulton & Cobb, 2017). A wealth of DDL research has been conducted to date (e.g., 489 studies in Boulton & Vyatkina, 2021), and the effectiveness of DDL has been reported for language forms such as vocabulary, lexico-grammar, grammar, and discourse (Boulton & Cobb, 2017). DDL is known as an effective methodology for error correction in L2 writing (e.g., Crosthwaite, 2017), teaching and raising learners' awareness of rhetorical functions and linguistic features (e.g., Charles, 2007; Flowerdew, 2015; D. Lee & Swales, 2006; Poole, 2016), and teaching pragmatic routines (Bardovi-Harlig et al., 2015).

Using DDL and consulting corpus data, learners can search the key words in context (KWIC) concordance line on a computer or on paper, often with teacher support, in a hands-on manner to discover patterns in vocabulary and grammar use in context. In DDL, learners begin by analyzing, observing, and identifying patterns. They then form their hypothesis regarding the usage of a word or phrase and then test and apply it. This discovery and inductive learning process correspond to constructivism (Boulton & Cobb, 2017; Cobb, 1999), one of the fundamental learning theories. Constructivism claims that learners actively construct their knowledge through experiences.

DDL creates a condition where "noticing" (Schmidt, 1990) and "focus on form" (Long, 1991) can be facilitated (Crosthwaite et al., 2019) by authentic language use. The self-directed nature of DDL, together with the above-mentioned theoretical underpinnings, could lead to cognitive and meta-cognitive development (Yoon & Jo, 2014) and greater learner autonomy (Boulton, 2010; Leńko-Szymańska & Boulton, 2015).

Recently, with cumulative research findings in the primary DDL studies, meta-analyses (Boulton & Cobb, 2017; H. Lee et al., 2019; Mizumoto & Chujo, 2015) have been conducted, and they all report the positive effects of DDL. For example, Boulton and Cobb (2017) synthesized effect sizes from 64 DDL studies (out of 205) from 1989 to 2014. They reported that for the control–experimental group comparisons ($k = 50$), the combined effect size was $d = 0.95$, 95%, confidence interval (CI) [0.67, 1.22], and was $d = 1.50$, 95% CI [1.28, 1.71] for the pre-post designs ($k = 71$). Both results can be considered medium to large effect sizes based on Plonsky and Oswald's benchmarks of L2 field-specific effect sizes (2014), which are small ($d = 0.40$), medium ($d = 0.70$), and large ($d = 1.00$) for mean differences between

groups and small (d = 0.60), medium (d = 1.00), and large (d = 1.40) for pre-post contrasts. Cobb and Boulton concluded from these findings that DDL is effective and generally results in significant gains in the outcome measures, especially when comparing results from meta-analyses of instructed SLA and computer-assisted language learning (CALL) (Plonsky & Ziegler, 2016).

Although Boulton and Cobb's (2017) meta-analysis shows that DDL is effective for L2 learning as a whole, we must be careful in interpreting the results when our focus is on writing or grammar. Specifically, looking at the control/experimental group comparison studies included in the meta-analysis, the effect size for writing (k = 14, d = 0.28, 95%CI [-0.14, 0.70]) was small, and the 95% CI includes zero, which indicates that we should not draw firm conclusions from the results. Similarly, grammar (k = 9, d = 0.62, 95%CI [-0.25, 1.50]) had a moderate effect size, but as in writing, it also includes zero in the 95% CI.

These inconclusive results may be due to variations in the DDL tasks. Table 1 (adopted from Mizumoto & Chujo, 2016, p. 56) summarizes a wide range of DDL interventions used in previous studies. The difference between "hard DDL" and "soft DDL" is based on Gabrielatos (2005). Hard DDL in this paradigm relates to more prototypical DDL, while soft DDL refers to more conventional instruction with minimal DDL elements. Soft DDL can be incorporated into the model because of the "data-driven" rather than "corpus-driven" label (Boulton, 2012). That is, DDL applications have tended to be somewhat broadened since the original definition given by Johns (1991). The amount of DDL studies that have been undertaken using Google and other online search engines (e.g., Han & Shin, 2017) as a DDL tool can be an illustration of this diversity. Given the possible dimensions and continuums of DDL tasks shown in Table 1, it is not hard to imagine that soft DDL with guided "convergent" tasks in combination with teacher-led activities and a deductive instructional approach (e.g., Smart, 2014) could yield better outcomes. This is because it is similar to explicit lexico-grammar or grammar instruction with the help of corpus data, and teachers and learners know the correct language forms. However, hard DDL with divergent (or open-ended) and inductive (i.e., without explicit instruction) tasks, such as error correction or writing revision without any teacher support, will pose a challenge to both teachers and learners unless the target items are pre-determined. In other words, the answers vary across the learners because the problems they tackle vary, unlike in deductive, teacher-led activities when it comes to error correction or writing revision. In addition, such an arduous DDL task will work in favor of learners with higher proficiency levels as they are equipped with an advanced level of lexico-grammatical/grammar knowledge (Oghigian & Chujo, 2012). For these reasons, it is not surprising that in Boulton and Cobb's (2017) meta-analysis, the results for writing are mixed. The same goes for grammar, especially when the benefits of DDL use are inspected in writing error revision.

Table 1. DDL Variations From Research (Adopted from Mizumoto & Chujo, 2016, p. 56)

Viewpoint	Possible Dimensions and Continuums		
	Hard DDL	← →	Soft DDL
Corpus data	Authentic	← →	Simplified
Corpus size	Large	← →	Small
Corpus purpose	General	← →	Specific
Concordancer	Web/Local computer	← →	Paper-based
Language	Monolingual	← →	Bilingual
Task	Divergent (No definite answers)	← →	Convergent (Definite answers)
Activity	Student-centered	← →	Teacher-led
Instruction	Inductive (Implicit)	← →	Deductive (Explicit)
Situation	Outside classroom	← →	In classroom
Grouping	Individual	← →	Pair/Group

DDL is often used for writing error correction. In fact, in their critical review of DDL use in academic writing, Chen and Flowerdew (2018) reported that almost a third of 37 studies addressed the

self-correction of errors. In most of those studies, the grammatical errors corrected with DDL were selected from common errors found in participants' writing. Thus the target grammatical errors in each study vary greatly. For example, Gaskell and Cobb (2004), in their study where they provided learners with the concordance line output in hyperlink format as feedback, selected ten typical errors suitable for corpus consultation: (1) articles, (2) conjunctions, (3) gerunds and infinitives, (4) noun plurals, (5) prepositions, (6) capitals and punctuation, (7) word order, (8) pronouns, (9) modals, and (10) subject/verb agreement. In a corpus training module in which students learned how to refer to corpora for self-correcting teacher-coded errors, Quinn (2015) created six error categories and error correction codes: (1) wrong word, (2) word choice, (3) word form, (4) preposition usage, (5) article/demonstrative usage, and (6) upgrade language choice. By deliberately limiting the number of error types using natural language processing (NLP) techniques, Tono et al. (2014) identified three error categories: (1) misformation (e.g., one word form should be substituted by the correct form as in "*Him major is economics."), (2) omission (e.g., prepositions or articles are missing), and (3) addition (e.g., containing redundant prepositions). Mueller and Jacobsen (2016), based on Japanese student essays from the International Corpus of Learner English (Granger et al., 2009), produced three generic error categories: (1) inappropriate collocates, (2) inappropriate preposition use, and (3) inappropriate word choice. By employing a more rigorous error coding classification than that of previous studies, Crosthwaite (2017) created seven error coding taxonomy: (1) omission, (2) deletion, (3) word choice, (4) word form, (5) morphosyntax (i.e., grammatical errors), (6) phrase (e.g., word order errors), and (7) collocation.

In addition to the wide variety of error types adopted in the studies mentioned above, it has been documented that "not all types of errors can be corrected equally well with a DDL approach" (Luo, 2016, p. 2). In Tono et al. (2014), corpus consultation resulted in the appropriate correction of omission and addition but not misformation because, as the authors have argued, the omission or addition errors were underlined so that learners were able to know which words to search for in the concordance line output whereas that was not the case with misformation errors (i.e., which words to look for was not explicit to learners). The same argument can be applied to the study by Crosthwaite (2017), which reported that errors of morphosyntax (e.g., tense and agreement errors) were less likely than other errors to be successfully revised with DDL-mediated error correction. That is, because there is no clear indication of which words or phrases to search for in the concordance line in the case of morphosyntax errors, the success of DDL error correction regarding these errors is not always guaranteed. Continuing the same line of argument, Crosthwaite (2017) documented that learners tended to use corpora to correct lexico-grammatical related errors, but that they were less likely to do so to correct errors of deletion or morphosyntax. This may be due to the indirect error feedback (i.e., indirect feedback by indicating and locating errors) employed in the study not being clear enough for learners to know what to search for in the corpus to resolve the errors. In the same vein, learners' perceptions of the usefulness of DDL for learning grammar were less than those of learning lexico-grammar (i.e., vocabulary and phrases).

Taken together, the type of target grammar errors and written corrective feedback should be carefully considered if DDL is to be used for grammar learning. As for the target grammar errors, limiting their number may be the key to successful DDL error correction (e.g., "overgeneralization of be" in Moon & Oh, 2018; "passive voice" in Smart, 2014). In addition, as it has been established that DDL is effective in correcting the errors of lexico-grammatical items, more emphasis should be placed on selecting morphosyntax items (i.e., dealing with grammar proper, not vocabulary or phrases) to convince learners to use DDL as a supplement to their reference tools (Crosthwaite, 2017, p. 450).

Recently, by reviewing learner corpus studies with Japanese EFL learners and their writing and speaking errors, Satake (2020) suggested that (1) article errors (especially article omission errors), (2) noun number errors, and (3) preposition errors should be focused on in EFL writing classes in Japan. After implementing a series of DDL-mediated error correction tasks, Satake found that for the above

three grammar items, corpus consultation helped accurately correct over 80% of errors, which indicates that DDL may be useful for correcting the characteristic grammar errors of Japanese EFL learners.

3. Purpose of the Study

This study attempts to verify and extend the three grammar error types, suggested by Satake (2020), which are characteristic to Japanese EFL learners by exploring other corpus data. An error-tagged learner corpus is used to identify characteristic grammar errors in Japanese EFL learners compared to grammar errors made by learners from other countries. This is because L2 writing errors are often affected by the learners' L1 (Appel & Szeib, 2018; Hawkins & Filipović, 2012). By doing so, the study aims to take full advantage of DDL for grammar learning and teaching. Grammar error items to be focused on in DDL tasks to promote accurate writing error correction are presented and will serve as a basis for future DDL research and practice.

4. Method

4.1 Corpus

As this study aimed to identify the typical grammatical errors of Japanese English learners, a learner corpus was used. As a learner corpus is a collection of L2 production data of learners' writing or speaking, it contains errors as they are and allows for a detailed analysis of learners' language use (see McEnery et al., 2019 for more information on the use of learner corpus in SLA research).

Among hundreds of learner corpora around the world (https://uclouvain.be/en/research-institutes/ilc/cecl/learner-corpora-around-the-world.html), we selected the Cambridge Learner Corpus First Certificate in English (CLC FCE) dataset (Yannakoudakis et al., 2011). The reasons for selecting this corpus are threefold. First, the CLC FCE dataset is error-tagged and contains the correct answers to incorrect words. Thus, it allows for comparison between wrong and correct expressions. Second, the CLC FCE dataset contains the test-taker's L1 information, which allows us to examine errors specific to a specific group of L1 speakers (in this study, Japanese) in comparison with errors of L1 speakers that speak other languages. Third, the corpus is free and publicly available, allowing other researchers to replicate our study, which is often not possible with other learner corpora.

The CLC FCE dataset is a learner corpus of short essays (two essays from each learner) in response to exam prompts eliciting free-text responses. It has responses from 1,244 test-takers who took the Cambridge ESOL First Certificate in English (FCE) in 2000 and 2001. The FCE exam qualifies candidates for level B2 (higher intermediate) of the Common European Framework of Reference (CEFR). It is a subset of the Cambridge Learner Corpus (CLC) (Nicholls, 2003) and can be downloaded free of charge (https://ilexir.co.uk/datasets/index.html). The dataset includes each test-taker's original text, score, and error annotations (errors and correctly rewritten expressions) for two writing tasks, each between 120 and 180 words. It also contains demographic information such as the test-taker's L1, age, sex, education history, and years of English study. The CLC FCE dataset provides data in the XML (Extensible Markup Language) format. It is designed to search for tags and retrieve test-takers' information and errors. Python (version 3.8.10) was used to retrieve tags.

summarizes the L1 of the test-takers included in the CLC FCE dataset. Of these test-takers, there were 16 different L1 backgrounds. The data for Japanese L1 speakers (n = 81) were extracted and analyzed in the current study.

Table 2. L1 of 1,244 Test-takers in the CLC FCE Dataset

L1	Number of Test-takers
Spanish	200
French	146
Korean	86
Russian	83
Japanese	81
Polish	76
Italian	76
Turkish	75
Greek	74
German	69
Portuguese	68
Chinese	66
Catalan	64
Thai	63
Swedish	15
Dutch	2
Total	1,244

In the annotated XML files, error tags are given based on a taxonomy of 77 error types (see Table 3). The following sentence is an example of error tags in an XML file.

<p>I am writing to reply <NS type="MT"><c>to</c></NS> <NS type="RD"><i>your</i><c>the </c></NS> letter you wrote <NS type="MT"><c>to</c></NS> me on 10 June.</p>

The errors are enclosed by <NS type> tags with <i> denoting an incorrect word and <c> correction. The first error type, "MT," stands for "missing preposition," so that no incorrect word is tagged and only the correction is provided. The second error type, "RD," indicates "replacement determiner," and the incorrect word "your" should be replaced with the correct determiner, "the." This way, individual test-taker's linguistic errors can be detected and extracted for detailed analysis.

4.2 Analysis

The purpose of the current study is to reveal the grammatical errors typically made by Japanese EFL learners in an error-tagged learner corpus in comparison with other EFL learners with different L1 backgrounds. To this end, we first performed correspondence analysis to reveal the overall pattern. Correspondence analysis is a statistical approach for examining the relationships between variables in a frequency table. For the correspondence analysis, a matrix of the 75 error types and 16 L1s of the test-takers was constructed (see Online Appendix for the specific data structure: https://osf.io/nw76h/). It should be noted that although the whole dataset of the Cambridge Learner Corpus (CLC) (Nicholls, 2003) has a taxonomy of 77 error types (Table 3), 75 are used in the CLC FCE dataset. This is because two errors, DC (conjunction derivation) and QL (question prompt error), were not found in the CLC FCE dataset.

By using correspondence analysis, the relationships between rows and columns in a frequency table can be examined in a compressed form called reduced latent dimensions (Hair et al., 2019). Because the results of correspondence analysis can be visually displayed in a two-dimensional graph in which the closeness of each variable represents similarity, the associations between the row and column variables can be intuitively interpreted. In our study, the points on a two-dimensional graph represent each type of error and each L1 background. The closer two points are on the graph, the stronger the relationship (i.e., the more likely those types of errors are to occur among learners from

that L1 background). We thus used a graphical representation to examine the relationship between error types and test-takers' L1s.

Table 3. The Error Codes, Meanings, and Their Frequencies in the CLC FCE Dataset

Code	Meaning	Japanese	Other L1s	Sum
AG	Agreement	0	5	5
AGA	Pronoun agreement	7	188	195
AGD	Determiner agreement	3	118	121
AGN	Noun agreement	43	784	827
AGQ	Quantifier agreement	2	47	49
AGV	Verb agreement	55	880	935
AS	Argument structure	15	195	210
CD	Determiner countability	0	7	7
CE	Compound error	6	130	136
CL	Collocation	1	23	24
CN	Noun countability	13	205	218
CQ	Quantifier countability	4	59	63
DA	Pronoun derivation	12	205	217
DC	Conjunction derivation	0	0	0
DD	Determiner derivation	5	81	86
DI	Determiner inflection	0	9	9
DJ	Adjective derivation	34	583	617
DN	Noun derivation	40	506	546
DQ	Quantifier derivation	0	9	9
DT	Preposition derivation	1	11	12
DV	Verb derivation	9	155	164
DY	Adverb derivation	22	409	431
FA	Pronoun form	0	20	20
FD	Determiner form	3	103	106
FJ	Adjective form	5	72	77
FN	Noun form	58	830	888
FQ	Quantifier form	0	1	1
FV	Verb form	65	1,746	1,811
FY	Adverb form	2	40	42
IA	Pronoun inflection	0	11	11
ID	Idiom	19	381	400
IJ	Adjective inflection	4	122	126
IN	Noun inflection	3	141	144
IQ	Quantifier inflection	0	25	25
IV	Verb inflection	19	433	452
IY	Adverb inflection	0	4	4
L	Register	21	168	189
M	Missing	48	593	641
MA	Missing pronoun	30	956	986
MC	Missing conjunction	5	342	347
MD	Missing determiner	286	2,701	2,987
MJ	Missing adjective	2	40	42
MN	Missing noun	13	225	238
MP	Missing punctuation	154	2,816	2,970
MQ	Missing quantifier	5	155	160
MT	Missing preposition	109	1,340	1,449
MV	Missing verb	39	761	800
MY	Missing adverb	14	270	284
QL	Question prompt error	0	0	0
R	Replacement	162	2,271	2,433

RA	Replacement pronoun	48	811	859
RC	Replacement conjunction	14	212	226
RD	Replacement determiner	60	618	678
RJ	Replacement adjective	51	854	905
RN	Replacement noun	103	1,994	2,097
RP	Replacement punctuation	156	3,428	3,584
RQ	Replacement quantifier	12	177	189
RT	Replacement preposition	141	3,204	3,345
RV	Replacement verb	180	3,410	3,590
RY	Replacement adverb	51	833	884
S	Spelling (non-word)	247	4,709	4,956
SA	American spelling	27	224	251
SX	Spelling (real word)	32	767	799
TV	Verb tense	163	3,192	3,355
U	Unnecessary	12	324	336
UA	Unnecessary pronoun	14	380	394
UC	Unnecessary conjunction	6	177	183
UD	Unnecessary determiner	70	1,262	1,332
UJ	Unnecessary adjective	2	79	81
UN	Unnecessary noun	14	229	243
UP	Unnecessary punctuation	55	1,343	1,398
UQ	Unnecessary quantifier	5	55	60
UT	Unnecessary preposition	81	1,012	1,093
UV	Unnecessary verb	30	490	520
UY	Unnecessary adverb	12	306	318
W	Word order	62	1,497	1,559
X	Negation	11	126	137

To further investigate the error types of Japanese EFL learners in comparison with those of other English learners with different L1 backgrounds, based on the frequency information in Table 3, we calculated the log odds ratios and their corresponding 95% CIs to quantify the error occurrence rate of Japanese test-takers in comparison with other test-takers.

R version 4.1.2 was used for the correspondence analysis. To ensure the reproducibility and transparency of the data analysis, the data and R code used in this study are shared online (https://osf.io/nw76h/).

5. Results

The results of the correspondence analysis are presented in Figure 1. The error types close to the origin (i.e., 0) in the figure are the common errors that all learners tend to make. In contrast, error types located away from the origin are rare errors. As Table 3 shows, some of them are very frequent or very infrequent (e.g., FQ). On the right side of Dimension 1, languages known to have linguistic similarities, such as French, Portuguese, Italian, Spanish, Catalan, and German, all line up. On the left side are languages that do not have articles, like Turkish, and Japanese is one such language and is located close to Korean, Thai, and Chinese. Error types close to Japanese are FN (noun form), RD (replacement determiner), and CQ (quantifier countability), all of which are error types related to noun use.

Overall, the results of the correspondence analysis indicate that the taxonomy of the error codes and their frequencies shown in Table 3 reflects the errors made by L2 writers from different L1 backgrounds in the CLC FCE Dataset. In other words, the taxonomy captures differences between L1 groups well. Accordingly, the error types characteristic of a specific L1 (in this study, Japanese) can be

further explored with this data.

Next, to pinpoint the errors that are more specific to Japanese English learners, we calculated the odds ratio for each error type. This ratio compares the likelihood of a given error occurring among Japanese test-takers versus test-takers of other native languages. Essentially, an odds ratio tells us how much more (or less) likely Japanese learners are to make a particular mistake.

For example, if an odds ratio is 3 for a particular grammar error, it means that this error is three times more likely to be made by a Japanese learner than a learner of a different native language. However, it is not enough for the odds ratio to be above 1, the lower limit of the 95% confidence interval (CI) for that odds ratio also needs to be above 1. This indicates that we can be 95% confident that this error is truly more common among Japanese learners.

The reasoning behind this is that universal errors, that is, errors made regardless of the learner's first language, will naturally decrease as proficiency increases. However, errors more specific to Japanese learners may require targeted teaching.

summarizes the grammar error types that were more prevalent among Japanese EFL test-takers from the highest to lowest odds ratio. Only the errors with an odds ratio (and its 95% CI lower limit) above 1 are included, signaling these errors are more characteristic of Japanese test-takers.
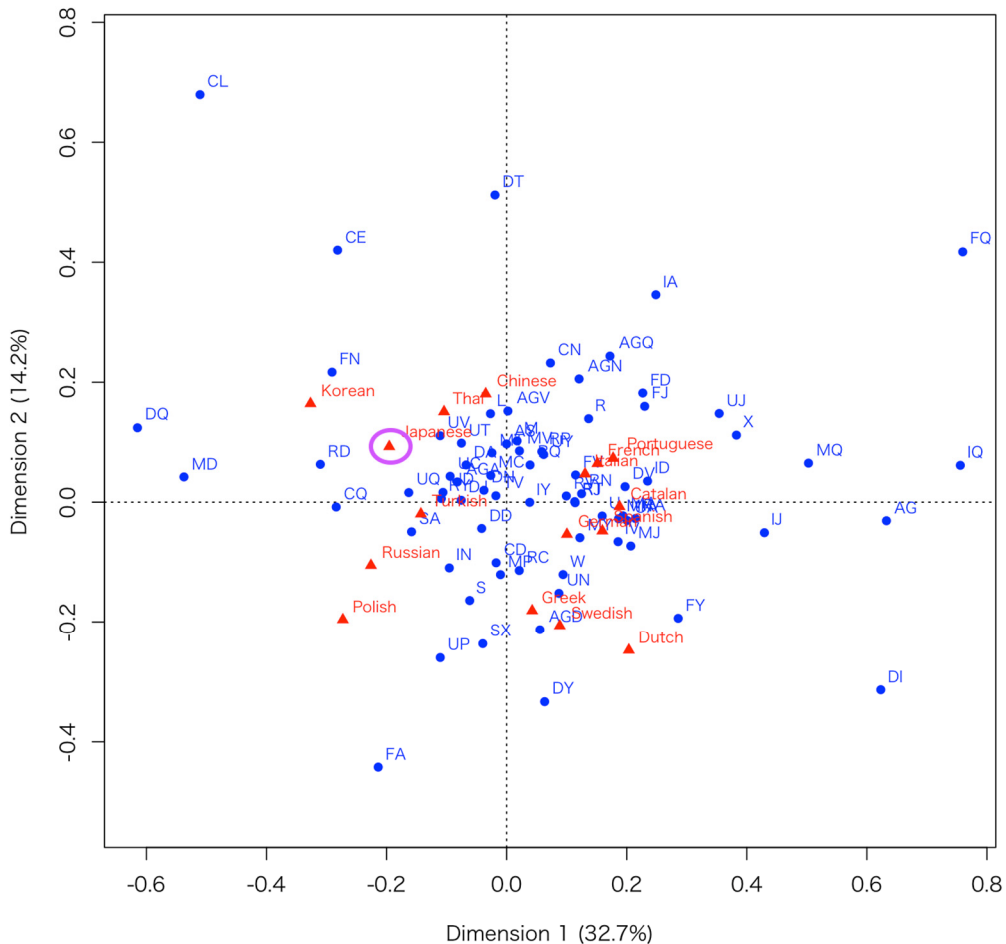
Figure 1. The Result of Correspondence Analysis

Note. Refer to Table 3 for the description of each error code.

Table 4. The Grammar Error Types More Likely to Occur in the Texts of Japanese EFL Learners

Code	Description	Japanese (*n* = 81)[a]		Other L1s		Odds Ratio	95% CI	
		Frequency	Percentage	Frequency	Percentage		Lower	Upper
MD	Missing determiner	286	22.0%	2,701	11.4%	1.94	1.69	2.23
RD	Replacement determiner	60	4.6%	618	2.6%	1.78	1.36	2.33
M	Missing	49	3.8%	592	2.5%	1.52	1.13	2.04
MT	Missing preposition	109	8.4%	1,340	5.6%	1.49	1.22	1.83
UT	Unnecessary preposition	81	6.2%	1,012	4.3%	1.47	1.16	1.85
DN	Noun derivation	40	3.1%	506	2.1%	1.45	1.04	2.01
R	Replacement	162	12.5%	2,271	9.5%	1.31	1.10	1.55
AGVb	Verb agreement	55	4.2%	880	3.7%	1.15	0.87	1.51

Note. [a] Each test-taker composed two short texts, resulting in a file count that is twice the number of test-takers (k = 162). The total error tags amount to 1,298 for Japanese and 23,782 for Other L1s. [b] AGV is provided as an example of a result that is statistically non-significant with respect to the 95% CI. Further explanation is offered in the main text. For statistics concerning other error types, refer to the online supplementary material available at https://osf.io/nw76h/.

If the 95% Confidence Interval (CI) of an odds ratio falls below 1, it signifies an inconclusive result, similar to non-statistical significance ($p > .05$). For instance, consider the odds ratio for AGV (verb agreement), listed at 1.15 at the bottom of Table 4. This suggests that this type of error might be more prevalent in the text of Japanese examinees. However, because the 95% CI includes 1 (95% CI [0.87, 1.51]), we cannot definitively assert that this error is more common among Japanese learners. By contrast, all the error types listed in Table 4 have 95% CIs that exclude 1. This bolsters our confidence in identifying the types of errors to which Japanese EFL learners are particularly prone.

In Table 4, Both MD (missing determiner) and RD (replacement determiner) are determiner-related errors. In the case of MD, learners often missed adding determiners such as *the*, *a*/*an*, *my*, and *our* to the noun that follows (e.g., the name of [*the*] hotel, [*a*] few years ago, take [*an*] exam). As this type of error tends to occur when students lack an awareness of noun countability (e.g., [*a*] fantastic idea), it is expected that, although they are not listed in Table 4, FN (noun form) and CN (noun countability) are the potential causes of these errors. In fact, the odds ratios for FN and CN are both over 1, at 1.28 (95% CI [0.98, 1.68]) and 1.16 (95% CI [0.66, 2.04]), respectively. As for RD, almost all errors were caused by confusing *a* and *the* (e.g., I'm not *the* [*a] kind of person, in *the* [*a] day time, send me *a* [*the] letter, have *a* [*the] student discount).

The next error category, M (missing), is a mixture of errors in which two or more words are missing, for example: "It was [*at the*] beginning of this summer." In this case, a preposition and a determiner are missing. In some cases, the errors may be due to the effect of learners' L1. If a learner thinks of a sentence in Japanese and then translates it into English, it is difficult for them to realize why/how the produced sentence could be incomplete or sound unnatural (e.g., "I asked [*for a*] discount ticket"). This type of error is difficult to notice, even for advanced learners. As such, learners need explicit feedback from their teacher so they can know how to correct the sentence.

Misuse of prepositions is associated with the two categories MT (missing preposition) and UT (unnecessary preposition). The MT errors are not distributed toward particular prepositions, but rather a variety of prepositions are used based on the prepositional phrases which they are used with. The following are the prepositions in descending order of frequency: *to* (28 cases), *in* (18 cases), *for* (13 cases), *at* (12 cases), *about* (9 cases), *of* (8 cases), *on* (7 cases), *from* (5 cases), *with* (4 cases), *by* (3 cases), *along* (1 case), and *as* (1 case). The most frequent preposition, "*to*," is often used with the verb "*go.*" Sometimes, learners simply do not add the preposition and write, "I prefer to go [*to*] department stores." In other cases, MT is caused by the sentence being complex; for example, in a relative pronoun clause (e.g., "famous places which we want to go [*to*]"). We can assume that even proficient learners may make mistakes in this error type.

The UT errors are more varied than the MT errors. The most common UT errors listed in order of frequency were: *in* (16 cases), *for* (15 cases), *to* (12 cases), *as* (7 cases), *at* (6 cases), *about* (5 cases), *with* (5 cases), *from* (4 cases), *of* (4 cases), *on* (2 cases), *about* (1 case), *by* (1 case), *like* (1 case), *until* (1 case), and *without* (1 case). Regarding erroneous use, there were typical errors: adding prepositions for transitive verbs such as "answer [*for*], mention [*about*], contact [*with*], and marry [*with*]," and writing a preposition for adverbs where no preposition is necessary, such as "go [*to*] there" and "go [*to*] abroad." These errors are categorized as preposition errors; however, they are inextricably linked to verb usage. To prevent learners from making such errors, it is necessary to make them aware of the appropriate combination of verbs and prepositions by primarily focusing on transitive and intransitive verbs.

DN (noun derivation) is an error that results from using the wrong form of a noun. This error may occur because learners do not pay enough attention to the correct noun form of a word, or they remember the form but are uncertain. For example, in the CLC FCE dataset, test-takers use a verb as a noun, such as using "*complain*" instead of "*complaint*" or "*compensate*" instead of "compensation." In other cases, learners overgeneralize the rule of the "ing" form and use it as a noun, such as "*sporting*" for "*sport*," "*wasting*" for "*waste*," "*working*" for "*work*," and "*studying*" for "*study*." It is evident that learners need to become more aware of the form, meaning, and use of vocabulary (Nation, 2013), as their vocabulary as it relates to the nouns mentioned above can still be considered partial. At the same time, teachers can help learners develop their understanding of the parts of speech of a word, especially in writing or speaking.

Finally, the R (replacement) error type is an error in which a word or a phrase needs replacing. As is the case with the error type M (missing), R contains two or more words. That is why it is a generic term compared with other specific error types, such as RD (replacement determiner). The error tag, R, is unique in that, in most cases, the <i> (i.e., incorrect word) and <c> (i.e., correction) tags are not included. That is, no suggestion for correction is provided within the R tag (e.g., "If I had known <NS type= "R">all of them</NS>"). This is because the phrases did not make much sense to the person in charge of tagging errors, and writing or suggesting correct phrasing in such cases was simply impossible. Thus, it may well be the case that, for these errors, consulting corpus data may not be effective as they simply need to be rephrased.

6. Discussion and Implications

The current study's findings can be summarized as follows: from the correspondence analysis, it was found that the common errors that are particular to Japanese EFL learners are related to noun use. Further analysis with odds ratio and its corresponding 95% CI targeting all the error types made by Japanese test-takers and the errors of other test-takers revealed that errors related to (a) determiners, (b) prepositions, and (c) nouns are the three error types that deserve attention in the teaching and learning of grammar. As such, these errors are the ones characteristic to Japanese EFL learners. Taken together, the results of this study provide some supporting evidence for the suggestion by Satake (2020) that (a) article errors, (b) noun (number) errors, and (c) preposition errors should be taught with DDL in Japanese EFL writing classes.

These findings have significant implications for the use of DDL in grammar instruction. Given that DDL allows for targeted, data-driven exploration of language use, it could be particularly effective in addressing these common error types. For instance, educators could use corpora to provide real-life examples of correct noun use, determiner application, and preposition placement. Students could also be encouraged to conduct their own investigations into these areas, promoting learner autonomy and a deeper understanding of these grammatical concepts.

On a practical level, our findings suggest that educators teaching Japanese EFL learners should

prioritize instruction on noun use, determiners, and prepositions. Incorporating DDL methods into this instruction could provide learners with a more nuanced understanding of these grammatical concepts and help them avoid common errors.

Theoretically, our results contribute to the growing body of evidence supporting the use of DDL in language instruction. They suggest that DDL can be particularly effective when it is targeted toward the specific error types common among a particular group of learners. This adds a new dimension to our understanding of DDL, highlighting the importance of tailoring DDL methods to the specific needs and common errors of the learner group.

While our findings suggest that DDL can be effective in addressing common error types in Japanese EFL learners, we recognize the need for practical guidance on how these methods can be implemented in real-world classroom settings. One possible approach is to integrate DDL activities into existing grammar lessons. For instance, a lesson on noun use could begin with a traditional explanation and practice exercises, followed by a DDL activity where students use a corpus to investigate real-life examples of noun use. This would allow students to see the grammatical concept in context and gain a deeper understanding of its usage.

We also acknowledge that implementing DDL methods may pose practical challenges. Limited access to technology can be a barrier, particularly in low-resource settings (Leńko-Szymańska, 2015). However, DDL activities can be adapted to be done in pairs or groups (e.g., Smart, 2014), allowing students to share resources. Additionally, teachers can prepare printouts of corpus data for classroom use (Boulton, 2010). Resistance from students unfamiliar with DDL is another potential challenge. To address this, teachers can introduce DDL methods gradually, starting with guided activities and providing plenty of support (Mizumoto & Chujo, 2016). Over time, as students become more comfortable with these methods, they can be given more autonomy in their data-driven investigations.

As this study aimed to identify the grammar error types to be focused on in DDL tasks for the promotion of accurate error correction in writing, a few more pedagogical implications for future DDL research and practice are discussed here.

First, given that learners are unlikely to check the concordance line for grammar error correction (Crosthwaite, 2017), the number of error types to be corrected should be limited when using DDL for grammar instruction, and it should be planned in advance to maximize DDL's effectiveness. In addition to limiting the number of error types, the effectiveness of DDL varies depending on the type of written corrective feedback (Tono et al., 2014) and the explicitness of the error coding system. Thus, feedback should be optimized by considering whether a learner can refer to concordance lines to correct the relevant grammatical item while reducing the number of error codes (Crosthwaite et al., 2020).

Since contrasting error and correct usage examples, as in Moon and Oh's study (2018), is conducive to discovery-learning, using DDL to compare errors with their corrected words or phrases can also be effective. Specifically, we could make use of error-tagged corpora, such as the CLC FCE Dataset, accessible for pedagogical purposes as suggested by Collins and Ruivivar (2021) by creating an online tool that allows the simultaneous retrieval of both correct and error forms. Such a tool would make it easier for teachers to prepare tasks comparing errors and correct expressions and facilitate the use of DDL for grammar learning and teaching. Additionally, such a tool would help learners search for error tags as per the error codes they receive from their teachers' written corrective feedback. This would allow learners to engage in corpus consultation and decide what the error is and what the correct form is.

Here we make several suggestions regarding the teaching of nouns, articles, and prepositions that this study has shown need to be focused on in DDL for Japanese EFL learners. Because the Japanese language does not have articles or noun countability, it is not uncommon for Japanese EFL learners to fail to grasp these. Thus, in addition to understanding formal rules, learners need to deepen their semantic understanding of nouns through contextual examples using DDL. Noun countability could be made concrete by having the learner consider what concepts the error they tend to make often

displays. For instance, in Japanese, nouns themselves usually do not have plural forms, and the same form (*Ringo*) is used for both "apple" and "apples." Learners will gain a more tangible understanding of noun countability if they come to understand the difference between "many slices of apple" and "several apples." Therefore, it would be highly informative if multimodal information such as pictures could be presented simultaneously with the concordance lines, with the help of web search engines. For the articles, the errors learners make may well be rooted in misunderstandings or ignorance of specificity in discourse rather than the simple rule of uniqueness (i.e., the). For this reason, instruction at the suprasentential (i.e., discourse) level, with the aid of the concordance lines, could be effective in raising learners' awareness of the correct usage of the articles.

In order to deal with errors such as DN (noun derivation), in which learners do not know the correct noun form of a word, the use of wildcard queries (Crosthwaite et al., 2019) is an excellent asset to both learners and teachers. Searching with wildcards may seem daunting for learners, and learning how to query with wildcards will require proficiency and time to get used to. Even so, teachers should introduce it as part of DDL activities. Considering the fact that wildcard searches are used everywhere (e.g., Google), it would help learners become more autonomous in their L2 learning in the long run. Figure 2 shows examples of a wildcard and a vertical bar search. In addition to the wildcard search with an asterisk ("a wast*" above in the figure), the search with the vertical bar or pipe ("|") is potentially helpful in showing the noun form of the word ("his work|working" below in the figure). Needless to say, teachers should not only be familiar with these search methods but should also suggest to learners what search queries they should use when providing feedback on their writing. In addition, even when learners are taught how to search with a wildcard or vertical bar, they may not be able to use the search query properly (Crosthwaite et al., 2019) and thus require ongoing support and training from the teacher. It should be noted that the same applies to the POS (part-of-speech) search functions in corpora with POS tags (e.g., COCA: Corpus of Contemporary American English).

Left Context	Hit	Right Context
. They understood that. It would be	a waste	of money to put heaters along the fence
today. We're doing IRA." "Seems like	a waste	of time and resources in light of 9/11."
other," the Earl returned brusquely. "	A waste	of time, men, and opportunity in the pu
or sleep but she knew that would be	a waste	of time. She was browsing the books on

Left Context	Hit	Right Context
tain internal concerns that enlivened	his work	but chipped away at the scholar's quest
sense of humor who is serious about	his work	but not about himself, he says, "It's
omme des Garçons – like) display of	his work	and favorite antique furniture. Then he
an 100 educational films on physics.	His work	at UNESCO on integrated science led to
or "sun"). In any event, Sequoyah had	his work	cut out for him. Ordinarily, societies ac

Figure 2. Example of a Wildcard and a Vertical Bar Search

Note. Search terms were "a wast*" (above) and "his work|working" (below). American English 2006 (AmE06) (Potts & Baker, 2012) in AntConc version 4.0.7 (Anthony, 2022, https://www.laurenceanthony.net/software/antconc/) was used in this example.

Regarding prepositional errors, an understanding of the role of prepositions in the hierarchical structure of a sentence, such as clauses and phrases, is necessary. That is, understanding whether the propositional content of the clause or the phrase requires a prepositional phrase or not would be the

key when learners construct a sentence. For raising their structural awareness, the analytical use of concordance lines could be helpful. For example, in the sentence "Will slapped his face at the stage," the critical point is whether or not it can be explicitly understood that "at the stage" is secondary information to the clause "Will slapped his face." It would also be helpful to spot the prepositional phrase structure for the intransitive and transitive verbs, such as "He shouted [at him] {with some expressions of anger}." The integration of deductive grammar instruction and DDL (as outlined in Table 1) should be considered in this regard. Following this train of thought, within the context of deductive grammar instruction, the careful selection and provision of patterns for DDL would be essential in order to optimize learning outcomes. In support of this approach, O'Keeffe and Mark (2022) recently proposed a set of principles for the curation of language patterns to be used in DDL, with the application of these principles varying according to the learner's stage of language acquisition. Their work, fundamentally underpinned by the usage-based theory, integrates valuable insights drawn from both SLA and Learner Corpus Research (LCR).

In terms of providing level-specific language data, especially for Japanese EFL learners with lower proficiency, tools such as the Sentence Corpus of Remedial English (SCoRE) (Chujo et al., 2015) can be highly valuable. As demonstrated in Figure 4, SCoRE presents straightforward examples, acting as an aid for DDL in grammar instruction and learning. SCoRE is a complimentary, accessible, and web-based DDL program, offering its services to learners, educators, and material developers without any copyright restrictions, fostering an environment conducive to pedagogical innovation. Corpus usage for language learning is characterized by the employment of real-life language data. However, the authentic text can often pose a considerable challenge and can be overwhelming for beginners (Chujo et al., 2015). To overcome this hurdle, SCoRE incorporates sentences written with simplicity in mind, making them easily comprehensible for low-level learners. Moreover, to further aid the learning process, every sentence is provided with a Japanese translation. This feature significantly simplifies DDL activities for Japanese EFL learners at a lower level.

Figure 3. Search Result of "go to" in SCoRE

Note. SCoRE can be accessed at https://www.score-corpus.org/.

For errors such as L (register), M (missing), and R (replacement), as in this study, as well as tense errors (Satake, 2020), for which the learner and teacher alike do not know what to search for in the concordancer, we should reconsider whether it is necessary to check errors with concordance lines (i.e., DDL) in the first place. DDL is not a "panacea" (Boulton, 2009). Those who advocate for the use of DDL in all contexts should bear in mind that the advantage of corpus consultation is that it gets

students to explore grammar regularities and patterns and that lexico-grammatical errors can often be successfully addressed by searching concordance lines.

A few limitations of the current study should be acknowledged. First, the CLC FCE Dataset used in this study is a partial extraction of a large corpus; thus, it is necessary for the sake of reproducibility to check whether similar results can be replicated in other learner corpora. Second, as the CLC FCE Dataset was collected from the writing section of a test, it is plausible that the prompt or the genre of the writing task may have influenced the responses. From this perspective, the study should be replicated by targeting texts in a different genre. Finally, although the results of the present study revealed grammatical items that should be focused on in DDL research and practice, empirical studies such as Satake (2020) should be conducted to demonstrate the effectiveness of DDL with the grammar error items (i.e., nouns, articles, and prepositions) identified in this study.

7. Conclusion

The number of studies on DDL has been increasing in recent years, and DDL's overall effectiveness has generally been reported to be high. Thus, as Boulton and Cobb (2017) expressed, "the future of DDL looks rather bright" (p. 288). However, the extent of its effectiveness in grammar instruction, especially for error correction in L2 writing, is still inconclusive. To provide guidance for focused grammar instruction with DDL, we attempted to identify the characteristic grammatical errors made by Japanese EFL learners in the CLC FCE Dataset in this study. The results confirmed that the three error types (i.e., nouns, articles, and prepositions) suggested by Satake (2020) are worthy of attention in DDL grammar instruction for Japanese EFL learners. The findings of this study are particularly valuable because they provide a basis for future DDL research and practice, particularly for the use of DDL for grammar instruction in Japan. As the goal of DDL is to empower and cultivate autonomous learners, it is necessary to empirically test the approaches suggested in this study and document the evidence of growth as learners take charge of their own learning.

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