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Measuring NP Complexity in Korean EFL Writing across CEFR Levels A2, B1 and B2

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ABSTRACT

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The study reported in this article investigates noun phrase syntactic complexity in the writing of Korean EFL university learners across four kinds of CEFR proficiency levels (Common European Framework of Reference A2, B1_1, B1_2 and B2+) in the International Corpus Network of Asian Learners of English (ICNALE). The method employed to analyze all NPs in the current learner corpus is the measurement of NP complexity using the Tool for the Automatic Analysis of Syntactic Sophistication and Complexity (TAASSC). In order to see if NP complexity differs across the levels of proficiency in Korean EFL writing, this study analyzed fine-grained indices of four different components related to compound NPs, i.e., NP elaboration, nouns as modifiers and modifier variation, determiners, and possessives. The statistical results suggest that the variables of NP elaboration (e.g., prepositions per clause and adjectival modifiers per direct object) are stronger predictors of EFL writing proficiency than the other indices of NP complexity. The current findings broaden earlier corpus-based outcomes with respect to the measurement of EFL writing quality, NP complexity in particular. This study will hopefully lead to the expansion of new studies that can possibly explore the role of NP complexity and/or NP sophistication in accounting for foreign language writing proficiency.

KEYWORDS

TAASSC, NP complexity, ICNALE, Korean EFL writing

1. Introduction

The study of syntactic (or linguistic) complexity has been considered important in second language research because progress in language learning involves the development of L2 learners' syntactic abilities (Ellis 2003, Housen and Kuiken 2009, Larsen-Freeman 1983, Ortega 2003). Syntactic complexity has been defined as "the range of forms that surface in language production and the degree of sophistication of such forms" by Ortega (2003: 492). While a number of syntactic studies have paid much attention to L2 learners' language development (Ortega 2009), only a few studies have addressed complexity in the use of noun phrases (Kobayashi 2008, Osborne 2004), and to the best of the author's knowledge there has been no research concentrating on noun phrase (NP) complexity in Korean L2 writing at different proficiency levels.

Studies of complexity, accuracy and fluency (CAF) measures have been employed as indicators of learners' proficiency (Housen and Kuiken 2009); yet, noun-based complexity measures have not been fully investigated and recent corpus studies still depend on traditional gauges like number of dependent clauses per T-units, average clause length and mean sentence length (Alexopoulou et al. 2017, Foster and Tavakoli 2009). The lack of previous research in the analysis of noun complexity might be due to a common presumption that L2 learners may process nouns more easily than other types of words so that NP analysis might not bear an important implication on L2 learning and development (Ellis et al. 2016, Tomasello 2003, VanPatten 2002). However, researchers have reported that learning a linguistic item is a nonlinear process in that there is surely inter-speaker and intra-speaker variation and CAF values in L2 tend to increase as learners develop through interlanguage systems (Larsen-Freeman 1997, 2006, Verspoor et al. 2008, Vyatkina 2012, 2013).

The structure of NPs has been generally considered to contain constituents including the head, the determiners, the modifiers and the complements, and only the first two (the head and the determiner) are generally believed as fundamental elements (Biber et al. 1999); thus, NP complexity is regarded as the presence of non-fundamental constituents in NP. For example, the NP *the frequency* is more sophisticated than *the frequency of stop release*, which in turn is more sophisticated than *the frequency of stop release by English speakers*, according to Biber et al. (1999). This NP complexity can be analyzed by several automated tools such as L2 Syntactic Complexity Analyzer (L2SCA, Lu 2010), Coh-Metrix (McNamara et al. 2014), and Tool for the Automatic Analysis of Syntactic Sophistication and Complexity (TAASSC, Kyle 2016). First, L2SCA (Lu 2010) analyzes 14 measures grouped into five categories, i.e., length of production units (mean length of clause and sentence), sentence complexity (clause per sentence), subordination (dependent clause per clause and sentence), coordination (coordinate phrase per clause) and particular structures (complex nominals per clause and T-unit). Second, Coh-Metrix (McNamara et al. 2014) includes several cohesion measures related to text readability, but it also assesses texts on 11 measures of complexity classified into five categories, i.e., syntactic transformations, syntactic embeddings, phrase types, phrase length and sentence variety. McNamara et al. (2014), however, do not account for the calculation of those 11 complexity measures although they make a book-length discussion of cohesion measures.

On the other hand, TAASSC (Kyle 2016) calculates different phrasal types of indices, i.e., (i) average number of dependents per each phrase type and for all phrase types; (ii) occurrence of particular dependent types regardless of NP types; and (iii) average occurrence of particular dependent types in particular NP types (Kyle 2016: 56). TAASSC specifically allows the fine-grain analysis of NP complexity with four compound NP-related indices, i.e., (i) NP elaboration; (ii) nouns as modifiers and modifier variation; (iii) determiners; and (iv) possessives. First, *NP elaboration* includes 19 indices that measure prepositions (e.g., number of prepositions per nominal), adjectives (e.g., adjectival modifiers per nominal), determiners (e.g., determiners per nominal subject) and verbal

modifiers of nominals (e.g., verbal modifiers per nominal). A high score for NP elaboration component would indicate a higher degree of elaboration (Kyle 2016: 71). Next, the *nouns as modifiers and modifier variation* component includes seven indices that assess the use of nouns as direct object, nominal modifiers, variation in the number of modifiers per nominal, and nominal subject modifiers (e.g., nouns as a nominal dependent per nominal, dependents per direct object). A high score for this component would mean a higher number of nouns as modifiers as well as a wider variation in the number of dependents per nominal (Kyle 2016: 73). The third NP-related component, *determiners*, includes five indices that compute the use of determiners (e.g., determiners per nominal, object of the preposition, direct object or nominal subject). A high score for *determiners* would suggest a higher number of determiners like *a, the, this,* and so on (Kyle 2016: 74). Last, the *possessives* component includes four indices that measure the use of possessives (e.g., possessives per nominal, nominal subject, direct object or object of the preposition). A high score for this component would mean a high number of possessives such as *her*, *our*, *my*, and so on (Kyle 2016: 76).

The current study adopts the conceptualization of syntactic complexity operationalized in TAASSC, which has been identified to be enhanced predictors of writing quality based on fine-grained analyses of NP complexity. The goal of this paper is to conduct cross-sectional research of NP complexity in the EFL writing of Korean college level learners. This study uses syntactic complexity measures to examine differences in the linguistic complexity of the NPs written on an essay prompt by learners at four kinds of CEFR (Common European Framework of Reference) proficiency levels. Since no study has focused on NP complexity in Korean L2 writing at different language proficiency, the contribution of this study is that it can provide the characterization of NP complexity in L2 writing across all levels of proficiency by means of a variety of syntactic complexity indices. The present study aims to answer the following research questions: (i) what is the correlation between fine-grained indices of NP complexity and EFL writing proficiency levels? and (ii) if NP complexity differs across the levels of proficiency in Korean EFL learners, which features distinguish NP complexity across levels in the writing of university level Korean learners?

2. Method

The data analyzed in the present study are a subsection of the International Corpus Network of Asian Learners of English, ICNALE (Ishikawa 2013). The ICNALE is one of the largest learner corpora publicly available, which includes over 10,000 topic-controlled speeches and essays produced by English speakers and university students in different Asian countries, i.e., China, Hong Kong, Indonesia, Japan, Korea, Malaysia, Pakistan, the Philippines, Singapore, Taiwan and Thailand. The ICNALE consists of four modules (spoken monologue, spoken dialogue, written essays and edited essays), and the module of *written essays* is selected in the current study. This module controls prompts where learners were required to show their opinions about two statements, i.e., (i) It is important for college students to have a part-time job; and (ii) Smoking should be completely banned at all the restaurants in the country. The data analyzed in this study contain 69,950 words written by Korean university students in four kinds of CEFR-linked proficiency bands (Table 1) in response to the first statement (the *part-time job* prompt). The number of texts per level is the same as that of participants in each level since each student wrote a single text for the given prompt. An overview of the learner corpus analyzed per proficiency level is shown in Table 2.

Table 1. Mapping of Test Scores on CEFR Proficiency Bands (Ishikawa 2013)

CEFR	TOEIC	TOEFL PBT	TOEFL iBT	IELTS	STEP	VST
A2	-545	-486	-56	3+	3+	-24
B1_1	550+	487+	57+	4+	2+	25+
B1_2	670+	527+	72+	4+	2+	36+
B2+	785+	567+	87+	5+	Pre1+	47+

Note. VST = L2 vocabulary size test

Table 2. Overview of the Learner Corpus

CEFR	No. of texts	No. of words	Mean	*SD*
A2	75	16875	220.40	20.84
B1_1	61	13699	219.90	21.81
B1_2	88	20632	230.35	31.64
B2+	76	18744	242.14	35.82
Total	300	69950	228.73	29.93

The method employed to analyze all NPs in the current corpus was the measurement of NP complexity using TAASSC 1.3.8 (Kyle 2016). TAASSC includes a broad range of fine-grained NP complexity measures that capture the complication of nominal structures headed by nouns and pronouns as well as the constituents of the NP type. For the purpose of this study, 32 phrasal and three clausal indices were chosen for five NP types and five phrasal dependent types analyzed by TAASSC, as shown in Table 3.

Table 3. Types of Phrases and Dependents Analyzed in the Study (Adapted from Kyle 2016: 57)

Type (Abbreviation)	Example
Phrase type	
Nominal subject (nsubj)	[The boy in the blue plaid pants]$_{nsubj}$ gave the happy girl beautiful flowers.
Passive nominal subject (nsubj_pass)	[The happy girl]$_{nsubj\_pass}$ was given a flower by the boy in the blue pants.
Direct object (dobj)	The boy in the blue plaid pants gave the happy girl [beautiful flowers]$_{dobj}$.
Indirect object (iobj)	The boy in the blue plaid pants gave [the happy girl]$_{iobj}$ beautiful flowers.
Prepositional object (pobj)	The boy in [the blue plaid pants]$_{pobj}$ gave the happy girl beautiful flowers.
Dependent type	
Determiners (det)	[The]$_{det}$ boy in [the]$_{det}$ blue pants gave [the]$_{det}$ happy girl beautiful flowers.
Adjective modifiers (amod)	The boy in the [blue]$_{amod}$ pants gave the [happy]$_{amod}$ girl a flower.
Prepositional phrases (prep)	The boy [in the blue plaid pants]$_{prep}$ gave the happy girl beautiful flowers.
Possessives (poss)	That is [her]$_{poss}$ new BMW.
Verbal modifiers (vmod)	I have something [to say]$_{vmod}$ to you.

In order to see if NP complexity differs across the levels of proficiency in Korean EFL writing, this study analyzed four kinds of components related to compound NPs using TAASSC, i.e., (i) NP elaboration; (ii) nouns as modifiers and modifier variation; (iii) determiners; and (iv) possessives. The *NP elaboration* component includes 16 indices of NP complexity and three indices of clause complexity; the component of *nouns as modifiers and modifier variation* includes seven NP complexity indices; and the components of *determiners* and *possessives* include nine indices of NP complexity. Table 4 lists the entire set of NP complexity indices contained in the four different components.

Table 4. NP Complexity Indices Analyzed in this Study (Adapted from Kyle 2016)

Component	Index type	In text name
NP elaboration	NP complexity	dependents per nominal
	NP complexity	dependents per nominal subject
	NP complexity	dependents per object of the preposition
	NP complexity	dependents per nominal complement
	NP complexity	dependents per direct object (no pronouns)
	NP complexity	dependents per object of the preposition (no pronouns)
	NP complexity	adjectival modifiers per nominal
	NP complexity	prepositions per nominal
	NP complexity	verbal modifiers per nominal
	NP complexity	determiners per nominal subject
	NP complexity	adjectival modifiers per nominal subject
	NP complexity	prepositions per nominal subject
	NP complexity	adjectival modifiers per direct object
	NP complexity	prepositions per direct object
	NP complexity	adjectival modifiers per object of the preposition
	NP complexity	prepositions per object of the preposition
	Clause complexity	nominal subjects per clause
	Clause complexity	passive nominal subjects per clause
	Clause complexity	prepositions per clause
Nouns as modifiers and modifier variation	NP complexity	dependents per nominal (no pronouns)
	NP complexity	dependents per nominal (standard deviation)
	NP complexity	dependents per direct object (standard deviation)
	NP complexity	dependents per object of the preposition (standard deviation)
	NP complexity	nouns as a nominal dependent per nominal
	NP complexity	nouns as a nominal subject dependent per nominal subject (no pronouns)
	NP complexity	nouns as a direct object dependent per direct object
Determiners	NP complexity	determiners per nominal (no pronouns)
	NP complexity	subject determiners per nominal
	NP complexity	determiners per object of the preposition
	NP complexity	determiners per direct object
	NP complexity	determiners per nominal subject (no pronouns)
Possessives	NP complexity	possessives per nominal
	NP complexity	possessives per nominal subject
	NP complexity	possessives per direct object
	NP complexity	possessives per object of the preposition

3. Results and Discussion

A stepwise multiple linear regression analysis was conducted for each index to explore differences in NP complexity values across different proficiency levels. First, normality was checked threefold, i.e., (i) numerically with skewness and kurtosis (for a normal distribution both values should be close to zero); (ii) graphically with both distribution and Q-Q plots (when data are normally distributed, they have a symmetrical distribution in a distribution plot and all the points are close to the diagonal reference line in a Q-Q plot); and (iii) statistically with Shapiro-Wilk test (normally distributed data show no significant deviation) (Shapiro & Wilk 1965). Any indices that violated a normal distribution were removed from further consideration. Second, Pearson correlations were carried out on the remaining indices to find out if they were significantly correlated with proficiency levels. Any indices that did not satisfy an absolute correlation value of $r \geq 0.100$ with CEFR level and a significance of $p < 0.001$ were discarded

(Cohen 1988). Third, the remaining indices were checked for multicollinearity with both VIF and tolerance values to make sure that the final model contained unique indices only and multicollinear indices did not exaggerate the results of the regression analysis (Tabachnick & Fidell 2014). Finally, the remaining indices were entered into a stepwise multiple linear regression that used the AIC method (Akaike 1974). All statistical analyses including normality check, correlation analysis and stepwise multiple regression were conducted using JASP (JASP Team 2020).

3.1. Indices of Noun Phrase Elaboration

Out of a total of 19 *NP elaboration* indices, 11 were dropped since they violated a normal distribution, where a Shapiro-Wilk test showed a significant departure from normality, i.e., (i) dependents per nominal subject ($W = 0.929$, $p < 0.001$); (ii) dependents per nominal complement ($W = 0.957$, $p < 0.001$); (iii) verbal modifiers per nominal ($W = 0.868$, $p < 0.001$); (iv) determiners per nominal subject ($W = 0.923$, $p < 0.001$); (v) adjectival modifiers per nominal subject ($W = 0.898$, $p < 0.001$); (vi) prepositions per nominal subject ($W = 0.832$, $p < 0.001$); (vii) prepositions per direct object ($W = 0.896$, $p < 0.001$); (viii) adjectival modifiers per object of the preposition ($W = 0.963$, $p < 0.001$); (ix) prepositions per object of the preposition ($W = 0.914$, $p < 0.001$); (x) passive nominal subjects per clause ($W = 0.813$, $p < 0.001$); and (xi) prepositions per clause ($W = 0.971$, $p < 0.001$). Four of the remaining indices did not meet the minimum thresholds of $r \geq 0.100$ and $p < 0.001$ with CEFR levels and were discarded from the analysis, i.e., (i) dependents per nominal ($r = 0.058$, $p = 0.319$); (ii) dependents per object of the preposition ($r = 0.078$, $p = 0.177$); (iii) adjectival modifiers per nominal ($r = 0.053$, $p = 0.359$); (iv) and nominal subjects per clause ($r = -0.103$, $p = 0.074$). The remaining four indices (dependents per object of the preposition, dependents per direct object, adjectival modifiers per direct object, and prepositions per clause) were entered into a stepwise multiple linear regression (see Table 5). The resulting model, which contained two indices (prepositions per clause, and adjectival modifiers per direct object), explained 12.5% ($r = 0.353$, $R^2 = 0.125$) of the variance in proficiency levels (see Table 6).

Table 5. Correlations between CEFR Level and *NP elaboration* Variables

Variable	Mean (*SD*)	Correlation	*p*
Dependents per nominal	0.927 (0.215)	0.058	0.319
Dependents per nominal subject	0.483 (0.272)	-0.103	0.074
Dependents per object of the preposition	1.001 (0.279)	0.078	0.177
Dependents per nominal complement	1.951 (1.096)	0.033	0.566
Dependents per object of the preposition (no pronouns)	0.967 (0.279)	0.157	0.007**
Dependents per direct object (no pronouns)	1.335 (0.364)	0.124	0.032*
Adjectival modifiers per nominal	0.193 (0.086)	0.053	0.359
Adjectival modifiers per direct object	0.314 (0.173)	0.179	0.002**
Prepositions per nominal	0.112 (0.059)	-0.017	0.770
Prepositions per clause	0.235 (0.104)	0.318	<0.001***
Prepositions per nominal subject	0.065 (0.070)	-0.068	0.241
Prepositions per direct object	0.175 (0.134)	-0.026	0.652
Prepositions per object of the preposition	0.091 (0.080)	0.030	0.605
Verbal modifiers per nominal	0.027 (0.025)	0.053	0.363
Determiners per nominal subject	0.111 (0.089)	-0.051	0.383
Adjectival modifiers per nominal subject	0.107 (0.095)	-0.092	0.113
Adjectival modifiers per object of the preposition	0.156 (0.107)	0.043	0.454
Nominal subjects per clause	0.668 (0.139)	-0.103	0.074
Passive nominal subjects per clause	0.025 (0.029)	-0.006	0.919

Table 6. Summary of Multiple Regression Model for *NP elaboration* Variables

Entry	Predictors included	*R*	R^2	R^2 change	*β*	*SE*	*B*
1	Prepositions per clause	0.318	0.101	0.101	3.279	0.585	0.305
2	Adjectival modifiers per direct object	0.353	0.125	0.024	1.004	0.353	0.155

Note. *β* indicates unstandardized beta and *B* indicates standardized beta

The relationship between NP elaboration indices and CEFR proficiency levels was significant and it exhibited a medium effect size.[1] Four indices associated to NP elaboration satisfied the inclusion criteria and they were entered into a stepwise linear regression, i.e., dependents per direct object, dependents per object of the preposition, adjectival modifiers per direct object, and prepositions per clause. The resulting model included two indices (prepositions per clause, and adjectival modifiers per direct object) and explained approximately 13% of the variance in proficiency levels. These results provide support for the importance of the NP elaboration component in indexing EFL writing proficiency. The results also present further support for the significance of both clausal and phrasal complexity in that clause complexity involves the index of prepositions per clause, and adjectival modifiers per direct object is a phrasal complexity index (Kyle 2016). These findings do not appear to be consistent with the claims made by Biber et al. (2011) concerning the importance of phrase complexity over clause complexity in educational writing. Biber et al. (2011) have made a corpus-driven proposal that clausal subordination might not be appropriate for assessing second language proficiency of academic writing. The current results might be attributed to the prompt given to the EFL learners since they were asked to write an essay that expresses a viewpoint on the rather informal subject matter (*It is important for college students to have a part-time job*).

A linear regression using these two variables explained 12.5% of the variance in proficiency levels (see Table 6). The index related to prepositional phrase dependents accounted for 10.1% ($r = 0.318$, R^2 change = 0.101) of the variance in proficiency levels. These results indicate that the advanced B2+ level tended to include a substantial number of prepositional phrase modifiers in their essays. The writing samples from the ICNALE corpus given in Table 7 illuminates this tendency, showing that the beginning English learner had only one preposition for two clauses while the proficient learner used four prepositional phrase dependents in a single clause. On the other hand, the other index connected to direct object modifiers accounted for 2.4% ($r = 0.353$, R^2 change = 0.024) of the variance in CEFR levels. Learners of advanced levels had a tendency to contain direct objects with more dependents and a variety of dependents, as shown in learner samples of direct object dependents in the ICNALE essays (see Table 8). These findings suggest that direct object modifiers can be an important indicator of L2 writing proficiency even in essays that are not highly associated with formal learning or study.

Table 7. Examples from ICNALE Essays: Prepositions per Clause

Level	Example	Learner code
A2	*First, we are student. The most important part to us is study.*	W_KOR_PTJ0_001_A2_0
B2+	*At the end of the courses, executives of the companies decide to take some students for their spare worker.*	W_KOR_PTJ0_287_B2_0

Table 8. Examples from ICNALE Essays: Adjectival Modifiers per Direct Object

Level	Example	Learner code
A2	*So you must do something what you believe it.*	W_KOR_PTJ0_028_A2_0
B2+	*In doing so, students, who cannot be considered novices, try to realize their theoretical knowledge that they have learnt at school through practical things*	W_KOR_PTJ0_289_B2_0

[1] An effect size is a standard measure calculated from any number of statistical analyses. A multiple regression test calculates an effect size by the means of a multiple correlation coefficient, i.e., trivial $r < 0.100$, small $0.100 < r < 0.300$, medium $0.300 < r < 0.500$, large $r > 0.500$ (Goss-Sampson 2020).

Then, a series of one-way ANOVAs implemented in JASP were carried out to compare the effects of different proficiency levels; for all models, the dependent variable was each of the four indices that satisfied the correlation criteria and the fixed factor was the CEFR level. Table 9 provides descriptive statistics and ANOVA results of all dependent variables including these four indices. Independent one-way ANOVAs showed a significant effect of seven variables, i.e., (i) dependents per nominal subject: $F(3, 296) = 0.206$, $p < 0.05$; (ii) dependents per direct object (no pronouns): $F(3, 296) = 0.383$, $p < 0.05$; (iii) dependents per object of the preposition (no pronouns): $F(3, 296) = 0.248$, $p < 0.05$; (iv) determiners per nominal subject: $F(3, 296) = 0.023$, $p < 0.05$; (v) Adjectival modifiers per direct object: $F(3, 296) = 0.100$, $p < 0.05$; (vi) Passive nominal subjects per clause: $F(3, 296) = 0.003$, $p < 0.05$; and (vii) Prepositions per clause: $F(3, 296) = 0.110$, $p < 0.001$.

Table 9. Descriptive Statistics and ANOVA Results for *NP elaboration* Indices by Proficiency Level

	Proficiency level, Mean (*SD*)					
Index	A2	B1_1	B1_2	B2+	*F*	*p*
Dependents per nominal	0.942 (0.215)	0.876 (0.256)	0.913 (0.205)	0.970 (0.182)	2.481	0.061
Dependents per nominal subject	0.558 (0.275)	0.433 (0.284)	0.467 (0.273)	0.467 (0.246)	2.837	0.038*
Dependents per object of the preposition	1.011 (0.291)	0.920 (0.309)	1.005 (0.286)	1.052 (0.217)	2.632	0.050
Dependents per nominal complement	1.891 (0.939)	1.998 (0.974)	1.900 (1.058)	2.031 (1.359)	0.308	0.819
Dependents per direct object (no pronouns)	1.272 (0.343)	1.301 (0.471)	1.324 (0.329)	1.436 (0.305)	2.949	0.033*
Dependents per object of the preposition (no pronouns)	0.955 (0.286)	0.884 (0.302)	0.981 (0.291)	1.029 (0.221)	3.250	0.022*
Adjectival modifiers per nominal	0.192 (0.088)	0.182 (0.087)	0.195 (0.086)	0.202 (0.082)	0.636	0.593
Prepositions per nominal	0.117 (0.060)	0.104 (0.069)	0.114 (0.058)	0.111 (0.052)	0.620	0.603
Verbal modifiers per nominal	0.027 (0.026)	0.023 (0.030)	0.027 (0.021)	0.030 (0.023)	0.984	0.401
Determiners per nominal subject	0.132 (0.101)	0.093 (0.084)	0.099 (0.074)	0.119 (0.092)	3.014	0.030*
Adjectival modifiers per nominal subject	0.123 (0.094)	0.107 (0.100)	0.099 (0.093)	0.100 (0.093)	1.031	0.379
Prepositions per nominal subject	0.080 (0.079)	0.055 (0.073)	0.058 (0.059)	0.066 (0.067)	1.867	0.135
Adjectival modifiers per direct object	0.277 (0.168)	0.286 (0.161)	0.331 (0.168)	0.354 (0.184)	3.433	0.017*
Prepositions per direct object	0.181 (0.142)	0.162 (0.135)	0.189 (0.142)	0.162 (0.114)	0.797	0.496
Adjectival modifiers per object of the preposition	0.159 (0.118)	0.132 (0.107)	0.162 (0.109)	0.164 (0.090)	1.264	0.287
Prepositions per object of the preposition	0.093 (0.084)	0.079 (0.081)	0.095 (0.082)	0.095 (0.074)	0.585	0.625
Nominal subjects per clause	0.678 (0.157)	0.682 (0.164)	0.678 (0.129)	0.635 (0.103)	1.902	0.129
Passive nominal subjects per clause	0.028 (0.033)	0.024 (0.028)	0.017 (0.025)	0.030 (0.029)	3.235	0.023*
Prepositions per clause	0.190 (0.086)	0.220 (0.106)	0.246 (0.095)	0.280 (0.112)	11.118	<0.001***

Post hoc testing then was conducted for the indices where the minimum correlation thresholds were satisfied and the ANOVA results were significant to see if there is a significant difference between the levels (see Tables 10 through 13). As shown in Table 10, post hoc testing using Tukey's correction revealed that the B2+ level resulted in significantly greater use of direct object dependents than the A2 level ($p < 0.05$).

Table 10. Post-hoc Comparisons of CEFR Level and Dependents per Direct Object (No Pronouns)

Comparison	Mean diff.	*SE*	*t*	P_{tukey}
A2 vs. B1_1	-0.028	0.062	-0.456	0.968
A2 vs. B1_2	-0.052	0.057	-0.917	0.796
A2 vs. B2+	-0.163	0.059	-2.787	0.029*
B1_1 vs. B1_2	-0.024	0.060	-0.393	0.979
B1_1 vs. B2+	-0.135	0.062	-2.181	0.131
B1_2 vs. B2+	-0.111	0.056	-1.976	0.199

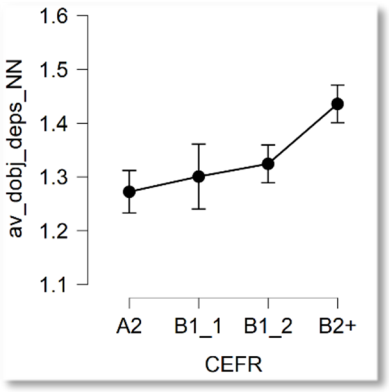

Figure 1. Comparisons of Dependents per Direct Object between CEFR Levels (av_dobj_deps_NN is an index name for dependents per direct object; error bars indicate standard error)

The tendency of greater use of the given index in the higher proficiency level shown in the direct object dependents was also observed in other variables including adjectival modifiers per direct object (see Table 12) and prepositions per clause (Table 13). There was a significant difference between the usage of direct object modifiers in levels A2 and B2+ ($p < 0.05$) as shown in Figure 3; there was also a significant difference between the two levels in the use of prepositional phrase dependents ($p < 0.001$) as shown in Figure 4. The unexpected fewer use of prepositional object modifiers observed in the B1_1 level might be due to the fact that the ICNALE uses the 2010 mapping scheme based on the official mapping guidelines offered by administrators of TOEFL in the year of 2006 although ETS has released a new technical report on the mapping of the TOEFL iBT scores on the CEFR, which relates 42+ (440+ in TOEFL PBT) to B1 and 72+ (533+ in TOEFL PBT) to B2 (Papageorgiou et al. 2015). Another possible reason for the seemingly uncommon tendency might be the range of VST (L2 vocabulary size test) scores. The EFL learners of the ICNALE were required to take a standard VST covering the top 5,000 word levels (Nation and Beglar 2007). Previous studies have shown that it is appropriate to measure the vocabulary size of nonnative speakers with a ceiling of 5K words (Meara and Milton 2003, Milton 2010). The difference of VST scores, however, does not seem to be sufficient enough to distinguish between levels A2 and B1_1, which is -24 and 25+, respectively (cf. Table 1).

Table 11. Post-hoc Comparisons of CEFR Level and Dependents per Object of the Preposition (No Pronouns)

Comparison	Mean diff.	*SE*	*t*	P_{tukey}
A2 vs. B1_1	0.071	0.048	1.495	0.442
A2 vs. B1_2	-0.026	0.043	-0.604	0.931
A2 vs. B2+	-0.074	0.045	-1.648	0.353
B1_1 vs. B1_2	-0.097	0.046	-2.116	0.150
B1_1 vs. B2+	-0.145	0.047	-3.060	0.013*
B1_2 vs. B2+	-0.048	0.043	-1.107	0.685

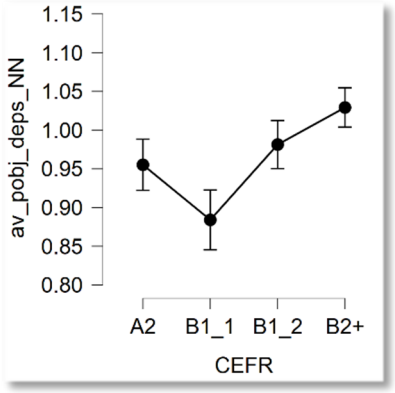

Figure 2. Comparisons of Dependents per Object of the Preposition between CEFR Levels (av pobj deps NN is an index name for dependents per object of the preposition; error bars indicate standard error)

Table 12. Post-hoc Comparisons of CEFR Level and Adjectival Modifiers per Direct Object

Comparison	Mean diff.	*SE*	*t*	P_{tukey}
A2 vs. B1_1	-0.010	0.029	-0.335	0.987
A2 vs. B1_2	-0.054	0.027	-2.017	0.184
A2 vs. B2+	-0.078	0.028	-2.802	0.028*
B1_1 vs. B1_2	-0.044	0.028	-1.556	0.406
B1_1 vs. B2+	-0.068	0.029	-2.317	0.096
B1_2 vs. B2+	-0.024	0.027	-0.888	0.811

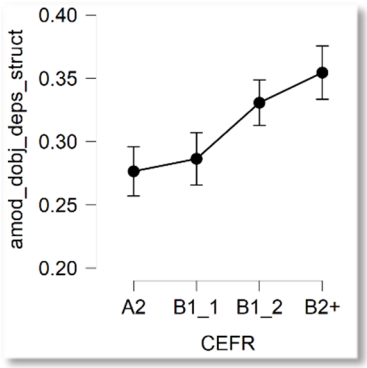

Figure 3. Comparisons of Adjectival Modifiers per Direct Object between CEFR Levels (amod_dobj_deps_struct is an index name for adjectival modifiers per direct object; error bars indicate standard error)

Table 13. Post-hoc Comparisons of CEFR Level and Prepositions per Clause

Comparison	Mean diff.	*SE*	*t*	P_{tukey}
A2 vs. B1_1	-0.029	0.017	-1.703	0.324
A2 vs. B1_2	-0.056	0.016	-3.552	0.002**
A2 vs. B2+	-0.090	0.016	-5.553	<0.001***
B1_1 vs. B1_2	-0.026	0.017	-1.588	0.387
B1_1 vs. B2+	-0.061	0.017	-3.549	0.003**
B1_2 vs. B2+	-0.034	0.016	-2.206	0.124

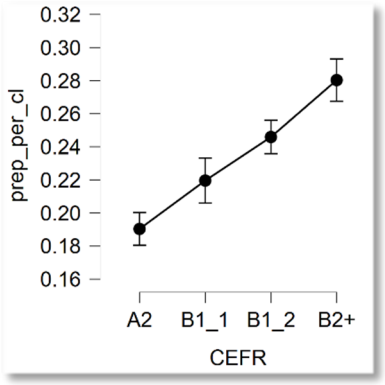

Figure 4. Comparisons of Prepositions per Clause between CEFR Levels (prep per cl is an index name for prepositions per clause; error bars indicate standard error)

3.2. Indices of Nouns as Modifiers and Modifier Variation

The variables of nouns as modifiers and modifier variation were statistically analyzed in terms of normal distribution and Pearson correlation as in the variables of NP elaboration. Three indices did not obey normality assumption and were eliminated from further examination, i.e., (i) nouns as a nominal dependent per nominal ($W = 0.919$, $p < 0.001$); (ii) nouns as a nominal subject dependent per nominal subject ($W = 0.809$, $p < 0.001$); and (iii) nouns as a direct object dependent per direct object ($W = 0.848$, $p < 0.001$). All the remaining four indices did not satisfy the minimum correlation thresholds of $r \geq 0.100$ and $p < 0.001$ and were discarded from the regression analysis, i.e., (i) dependents per nominal (no pronouns) ($r = 0.065$, p = 0.260); (ii) dependents per nominal (*SD*) (r = -5.375e-4, $p = 0.993$); (iii) dependents per direct object (*SD*) ($r = 0.012$, $p = 0.840$); and (iv) dependents per object of the preposition (*SD*) ($r = 0.068$, $p = 0.240$), as shown in Table 14.

Table 14. Correlations between CEFR Level and *nouns as modifiers and modifier variation* Variables

Variable	Mean (*SD*)	Correlation	*p*
Dependents per nominal (no pronouns)	1.156 (0.217)	0.065	0.260
Dependents per nominal (*SD*)	1.037 (0.187)	-5.375e-4	0.993
Dependents per direct object (*SD*)	0.981 (0.207)	0.012	0.840
Dependents per object of the preposition (*SD*)	0.896 (0.227)	0.068	0.240
Nouns as a nominal dependent per nominal	0.149 (0.103)	-0.022	0.709
Nouns as a nominal subject dependent per nominal subject (no pronouns)	0.220 (0.248)	0.073	0.209
Nouns as a direct object dependent per direct object	0.206 (0.222)	0.011	0.848

In order to compare the effects of different CEFR levels, a series of one-way ANOVAs were conducted; for all models, the dependent variable was each of the *nouns as modifiers and modifier variation* indices and the fixed factor was the writing proficiency level. Table 15 presents the descriptive statistics and ANOVA results of all dependent variables included in the indices of nouns as modifiers and modifier variation. Independent one-way ANOVAs showed a significant effect of a single variable, i.e., dependents per object of the preposition (*SD*): $F(3, 296) = 0.143$, $p < 0.05$; yet, since this variable did not meet the correlation inclusion thresholds, even though ANOVA reported a significant difference, a further analysis was not carried out such as post hoc testing.

Table 15. Descriptive Statistics and ANOVA Results for *nouns as modifiers and modifier variation* Indices by Proficiency Level

	Proficiency level, Mean (*SD*)					
Index	A	B	C	D	*F*	*p*
Dependents per nominal (no pronouns)	1.152 (0.217)	1.126 (0.275)	1.153 (0.210)	1.187 (0.168)	0.919	0.432
Dependents per nominal (*SD*)	1.048 (0.179)	1.017 (0.243)	1.036 (0.192)	1.042 (0.131)	0.335	0.800
Dependents per direct object (*SD*)	0.979 (0.221)	0.976 (0.256)	0.984 (0.198)	0.984 (0.156)	0.025	0.995
Dependents per object of the preposition (*SD*)	0.902 (0.221)	0.823 (0.228)	0.924 (0.228)	0.917 (0.222)	2.824	0.039*
Nouns as a nominal dependent per nominal	0.145 (0.103)	0.161 (0.120)	0.154 (0.107)	0.139 (0.084)	0.594	0.619
Nouns as a nominal subject dependent per nominal subject (no pronoun)	0.167 (0.194)	0.238 (0.272)	0.260 (0.275)	0.210 (0.237)	2.102	0.100
Nouns as a direct object dependent per direct object	0.180 (0.194)	0.260 (0.292)	0.185 (0.199)	0.210 (0.204)	1.837	0.141

3.3. Indices of Determiners

Two indices of *determiners* were not normally distributed and they were eliminated from further consideration, i.e., determiners per object of the preposition ($W = 0.974$, $p < 0.001$) and determiners per nominal subject (no pronouns) ($W = 0.956$, $p < 0.001$). All the remaining three indices did not meet the minimum correlation thresholds of $r \geq 0.100$ and $p < 0.001$ and were discarded from the regression analysis, i.e., (i) determiners per nominal (no pronouns) ($r = -0.012$, $p = 0.832$); (ii) determiners per nominal ($r = -0.030$, $p = 0.606$); and (iii) determiners per direct object ($r = -0.023$, $p = 0.695$), as shown in Table 16.

Table 16. Correlations between CEFR Level and *determiners* Variables

Variable	Mean (*SD*)	Correlation	*p*
Determiners per nominal (no pronouns)	0.283 (0.103)	-0.012	0.832
Determiners per nominal	0.221 (0.089)	-0.030	0.606
Determiners per object of the preposition	0.216 (0.130)	0.018	0.760
Determiners per direct object	0.348 (0.167)	-0.023	0.695
Determiners per nominal subject (no pronouns)	0.236 (0.165)	-0.019	0.749

A series of one-way ANOVAs were then carried out to compare the effects of different proficiency levels; for all models, the dependent variable was each of the *determiners* indices and the fixed factor was the CEFR level. Table 17 provides descriptive statistics and ANOVA results of all dependent variables included in the indices of

determiners. Independent one-way ANOVAs showed a significant effect of a single variable, i.e., determiners per nominal: $F(3, 296) = 0.025$, $p < 0.05$; although ANOVA reported a significant difference, since this index did not satisfy the correlation inclusion criteria, post hoc tests were not further conducted.

Table 17. Descriptive Statistics and ANOVA Results for *determiners* Indices by Proficiency Level

	Proficiency level, Mean (*SD*)					
Index	A	B	C	D	*F*	*p*
Determiners per nominal (no pronouns)	0.299 (0.104)	0.270 (0.119)	0.268 (0.095)	0.297 (0.097)	1.948	0.122
Determiners per nominal	0.239 (0.097)	0.206 (0.100)	0.204 (0.076)	0.234 (0.080)	3.272	0.022*
Determiners per object of the preposition	0.222 (0.129)	0.210 (0.160)	0.202 (0.117)	0.233 (0.116)	0.870	0.457
Determiners per direct object	0.363 (0.167)	0.333 (0.182)	0.344 (0.165)	0.349 (0.157)	0.363	0.780
Determiners per nominal subject (no pronouns)	0.253 (0.176)	0.219 (0.178)	0.230 (0.142)	0.242 (0.169)	0.573	0.633

3.4. Indices of Possessives

Two indices of *possessives* were removed since they did not demonstrate normal distributions, i.e., possessives per nominal subject ($W = 0.713$, $p < 0.001$) and possessives per object of the preposition ($W = 0.886$, $p < 0.001$). The remaining two indices (possessives per nominal, and possessives per direct object) were entered into a stepwise linear regression (see Table 18). The resulting model, which contained a single index (possessives per direct object), explained 7.6% ($r = 0.275$, $R^2 = 0.076$) of the variance in proficiency levels (see Table 19).

Table 18. Correlations between CEFR Level and *possessives* Variables

Variable	Mean (*SD*)	Correlation	*p*
Possessives per nominal	0.063 (0.042)	0.195	<0.001***
Possessives per direct object	0.083 (0.086)	0.275	<0.001***
Possessives per nominal subject	0.022 (0.032)	-0.063	0.279
Possessives per object of the preposition	0.105 (0.098)	-0.013	0.818

Table 19. Summary of Multiple Regression Model for *possessives* Variables

Entry	Predictors included	*R*	R^2	R^2 change	*β*	*SE*	*B*
1	Possessives per direct object	0.275	0.076	0.076	3.578	0.723	0.275

Note. *β* indicates unstandardized beta and *B* indicates standardized beta

The relationship between indices of possessives and CEFR proficiency levels was significant but it exhibited a small effect size. Two indices associated to possessives satisfied the inclusion criteria and were entered into a stepwise linear regression, i.e., possessives per nominal, and possessives per direct object. The resulting model included a single index (possessives per direct object) and explained approximately 8% of the variance in proficiency levels. These results suggest that advanced second language learners had a tendency to contain direct objects with a variety of dependents, as illuminated in learner writing samples of direct object possessives in the ICNALE essays (see Table 20). These findings are consistent with the result that adjectives modifying a direct object related to NP elaboration were used significantly more frequently by proficient learners. These results

present further support for the fact that direct object modifiers should be considered an important measurement of EFL writing proficiency.

Table 20. Examples from ICNALE Essays: Possessives per Direct Object

Level	Example	Learner code
A2	*College students are in favor of a part-time job. If part-time job can earn a lot of experience.*	W_KOR_PTJ0_028_A2_0
B2+	*Some students work in order to pay his tuition, while some students spend their time in order to make living on his own, and I strongly agree with the statement that college students have to have a part-time job because of the following two reasons.*	W_KOR_PTJ0_289_B2_0

Then, a series of one-way ANOVAs were conducted to compare the effects of CEFR levels; for all models, the dependent variable was each of the two indices that satisfied the correlation criteria, and the fixed factor was the L2 proficiency level. Table 21 provides descriptive statistics and ANOVA results of all dependent variables including these two indices. Independent one-way ANOVAs showed a significant effect of both variables, i.e., (i) possessives per nominal: $F(3, 296) = 0.007$, $p < 0.01$; and (ii) possessives per direct object: $F(3, 296) = 0.061$, $p < 0.001$.

Table 21. Descriptive Statistics and ANOVA Results for *possessives* Indices by Proficiency Level

	Proficiency level, Mean (*SD*)					
Index	A	B	C	D	*F*	*p*
Possessives per nominal	0.053 (0.042)	0.056 (0.042)	0.067 (0.040)	0.074 (0.042)	4.064	0.007**
Possessives per nominal subject	0.025 (0.038)	0.019 (0.030)	0.025 (0.033)	0.017 (0.027)	1.125	0.339
Possessives per direct object	0.055 (0.079)	0.071 (0.076)	0.084 (0.074)	0.121 (0.101)	8.752	<0.001***
Possessives per object of the preposition	0.114 (0.130)	0.091 (0.079)	0.106 (0.084)	0.105 (0.091)	0.640	0.590

Post hoc testing was then carried out for both indices to see if there is a significant difference between different levels (see Tables 22 and 23). As shown in Table 22, post hoc testing using Tukey's correction revealed that the level B2+ resulted in significantly greater use of nominal possessives than the level A2 ($p < 0.05$). The same tendency of greater use of nominal possessives for higher level learners was also observed in the variable of possessives per direct object ($p < 0.001$, Table 23). The most proficient level also led to significantly greater use of direct object possessives than the lower intermediate level B1_1 ($p < 0.01$) and the higher intermediate level B1_2 ($p < 0.05$).

Table 22. Post-hoc Comparisons of CEFR Level and Possessives per Nominal

Comparison	Mean diff.	*SE*	*t*	P_{tukey}
A2 vs. B1_1	-0.003	0.007	-0.417	0.975
A2 vs. B1_2	-0.014	0.007	-2.161	0.137
A2 vs. B2+	-0.021	0.007	-3.094	0.012*
B1_1 vs. B1_2	-0.011	0.007	-1.606	0.377
B1_1 vs. B2+	-0.018	0.007	-2.511	0.060
B1_2 vs. B2+	-0.007	0.006	-1.047	0.722

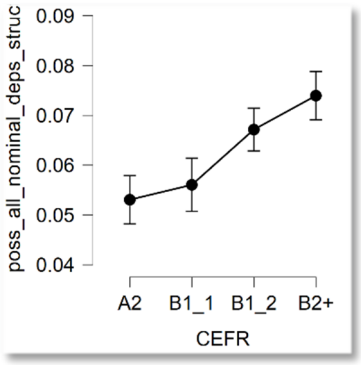

Figure 5. Comparisons of Possessives per Nominal between CEFR Levels (poss_all_nominal_deps_struct is an index name for possessives per nominal; error bars indicate standard error)

Table 23. Post-hoc Comparisons of CEFR Level and Possessives per Direct Object

Comparison	Mean diff.	*SE*	*t*	P_{tukey}
A2 vs. B1_1	-0.016	0.014	-1.107	0.685
A2 vs. B1_2	-0.029	0.013	-2.241	0.115
A2 vs. B2+	-0.067	0.014	-4.928	<0.001***
B1_1 vs. B1_2	-0.013	0.014	-0.968	0.768
B1_1 vs. B2+	-0.051	0.014	-3.555	0.002**
B1_2 vs. B2+	-0.037	0.013	-2.873	0.023*

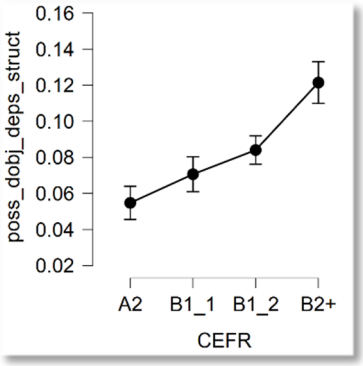

Figure 6. Comparisons of Possessives per Direct Object between CEFR Levels (poss_dobj_deps_struct is an index name for possessives per direct object; error bars indicate standard error)

3.5. Combined Model

The six indices entered into the previous multiple linear regression models by satisfying the assumption of normality and the minimum correlation thresholds were considered together, i.e., (i) dependents per object of the preposition (no pronouns), (ii) dependents per direct object (no pronouns), (iii) adjectival modifiers per direct object, (iv) prepositions per clause, (v) possessives per nominal, and (vi) possessives per direct object. Since all variables were normally distributed and none of them were collinear, all were entered into a stepwise multiple linear regression. The resulting model on the basis of three indices explained 18.1% of the variance ($r = 0.426$, R^2

= 0.181) in CEFR proficiency levels (see Table 24). The model suggested that indices associated to NP elaboration and possessives were predictive of CEFR level. The component of NP elaboration includes two indices, i.e., prepositions per clause, and adjectival modifiers per direct object. The two indices related to direct object modifiers accounted for 8% (5.8% for possessives per direct object and 2.2% for adjectival modifiers per direct object), while the index related to prepositional phrase dependents contributed 10.1% of the explained variance (r = 0.318, R^2 change = 0.101). The combined NP complexity model comprising components of NP elaboration and possessives was better in the perspective of explanatory power than either NP elaboration model or possessives model alone in that the NP elaboration model explained 12.5% of the variance and the possessives model only explained 7.6% of the variance in CEFR level. The results of the combined regression model suggest that NP elaboration is a critical feature observed in proficient L2 writing among different components of NP complexity such as determiners and nouns as modifiers. That is, more native-like L2 writers had a tendency to contain more elaborated direct objects and a variety of elaboration across clauses and direct objects. Essays written by proficient learners were particularly more likely to include more direct objects and clauses that are modified by adjectives, possessives and prepositional phrases as compared to those written by beginner level learners.

Table 24. Summary of Combined Multiple Regression Model

Entry	Predictors included	*R*	R^2	R^2 change	*β*	*SE*	*B*
1	Prepositions per clause	0.318	0.101	0.101	2.988	0.570	0.278
2	Possessives per direct object	0.399	0.159	0.058	3.104	0.688	0.239
3	Adjectival modifiers per direct object	0.426	0.181	0.022	0.972	0.342	0.150

Note. *β* indicates unstandardized beta and *B* indicates standardized beta

4. Conclusion

The present study examined the predictive effectiveness of four different components of NP complexity variables connected to clausal and phrasal complexity including NP elaboration, nouns as modifiers and modifier variation, determiners and possessives. The component of NP elaboration consists of 19 different indices that calculate prepositions, adjectives, determiners and verbal modifiers of nominals. The component of nouns as modifiers and modifier variation includes seven variables that evaluate the use of nouns as nominal modifiers, direct object, nominal subject modifiers and variation in the number of modifiers per nominal. The component of determiners comprises five indices that measure the use of determiners, and that of possessives includes four variables that assess the usage of possessives. The current statistical results suggested that fine-grain indices of NP elaboration (e.g., prepositions per clause and adjectival modifiers per direct object) were more powerful predictors of EFL writing proficiency than the other indices of NP complexity. The combined examination also demonstrated that the most efficient models will possibly involve variables related to components of both NP elaboration (prepositions per clause and adjectival modifiers per direct object) and possessives (possessives per direct object). The present findings broaden earlier corpus-based outcomes with respect to the measurement of EFL writing quality, NP complexity in particular. This study will hopefully lead to the expansion of new studies that can possibly explore the role of NP complexity and/or NP sophistication in accounting for EFL writing proficiency. Follow-up research will involve constructions that consist of a verb and all arguments it takes known as verb-argument constructions (VACs) as well as the frequency of VACs observed in foreign language writing.

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

