

Computer-Aided Analysis of Syntactic Elaboration of Written Argumentation Across Topics and L1s

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Abstract

Recent advances in computational linguistics and information retrieval have allowed for computationally investigating measures of linguistic elaboration in assessing writing. Together, these advances allowed for the automated analysis of syntactic complexity, text cohesion, and text structure. This study investigates the effect of within-genre topics on syntactic elaboration in argumentative essays written by EFL and ESL college students, contrasted with the essays of NS writers. To this end, this study attempted a quantitative approach to investigate the difference in syntactic complexity in argumentative writing taken from a learner corpus. L2SCA was introduced as a computer-aided analysis to calculate the syntactic complexity of argumentative writing written by students with different L1s. Furthermore, statistical analysis was conducted using the SPSS statistical program. In addition, Examples of text analysis were shown to supplement the weakness of the quantitative approach. Two hundred forty essays extracted from the International Corpus Network of Asian Learners of English were analyzed using the L2 Syntactic Complexity Analyzer. A two-way repeated measures MANOVA with the topic as a within-subjects variable and L1s as a between-subjects variable was conducted. The interaction effect was found to be significant, particularly at the phrasal complexity level, that is, coordinate phrases per clause. This finding suggests that patterns of topic effects on the three groups' phrasal coordination are likely to differ across their L1 backgrounds. The analysis, using seven measures covering multiple dimensions of syntactic complexity, revealed significant differences between EFL, ESL writers, and NS writers in using global and local complexities. This study also found a more substantial influence of L1 backgrounds on the syntactic complexity of writing in comparison to writing topics. Regarding simple main effects, all seven complexity indices were significantly affected by L1 backgrounds with large effect sizes, showing the practical meanings. With regard to topic effects, five of the seven complexity indices were significantly influenced.

Keywords: Learner corpus, ESL, EFL, writing topics, L1 backgrounds

Introduction

Writing proficiency has been regarded as one of the significant criteria for academic success. Writing is generally evaluated in internationally recognized standardized tests such as TOEFL and IELTS that assess English learners' competence in essay writing. The issue of the syntactic complexity of writing and its association with writing proficiency has received considerable attention from second language writing scholars and practitioners. Syntactic complexity is generally conceptualized as the range

of language forms and the sophistication degree of these forms produced in spoken or written discourse (Ortega, 2003). Furthermore, the value of syntactic complexity has been featured in second language writing as many past studies have explored how syntactic complexity in L2 writing is intricately connected to language proficiency or the quality of L2 writing during the decade (Lu, 2011; Ortega, 2003).

This strand of writing research has utilized conventionally different syntactic complexity measures as potential points of reference for language proficiency or development. Measures of syntactic complexity are crucial research tools in second language acquisition (SLA) and diverse language-related disciplines. This different use of measures has raised the awareness that syntactic complexity needs to be understood as a multidimensional construct and assessed at diverse structural levels, including global, clausal, and phrasal ones (Lu, 2017; Norris & Ortega, 2009). While writing studies showed variation regarding the indices of syntactic complexity adopted and the types of writing activities used, these studies reported a somewhat consistent tendency of syntactic complexity development. For instance, much research revealed that the density of complex phrasal units and the length of T-units or clauses are likely to increase with language proficiency and learning time (e.g., Jiang et al., 2019; Lu, 2011; Bulté & Housen, 2014; Mazgutova & Kormos, 2015; Yoon & Polio, 2017).

Meanwhile, there has been increasing attention to learner-related and task-related factors that are aligned with writing (Lu, 2011; Yoon & Polio, 2017). Numerous past studies have found that syntactic complexity can be influenced by diverse factors, such as L1 background (e.g., Lu & Ai, 2015), genre (e.g., Lu, 2011; Qin & Uccelli, 2016; Yoon & Polio, 2017), writing topic (e.g., Yang et al., 2015), and task type (e.g., Biber et al., 2016). Among the various dimensions of these factors, this study attempts to explore the issue of topic in writing since less is known about within-genre topic effects.

Notably, a sizable body of L2 writing research has attended to the inter-genre effects on syntactic elaboration, such as narration or argumentation (e.g., Beers & Nagy, 2009; Lu, 2011). Meanwhile, limited studies have dealt with writing topics within the same genre (e.g., Yang et al., 2015; Yoon, 2017).

Besides, L2 researchers have primarily centered on topic effects on one particular L1 group's linguistic features of syntactic complexity. Aside from topic effects, one particular learner-related factor that needs further exploration is L1 background. A growing body of writing literature on L1 backgrounds demonstrated potential L1-associated differences in terms of information structure (van Vuuren, 2013), syntactic structures (Rankin, 2012), and lexical bundles (Paquot, 2019). However, while this line of research has improved our understanding of writers' L1 backgrounds as a specific learner-related factor that impacts the learner's production, the current understanding of L1-related differences in L2 syntactic complexity has received scant attention in the literature.

Taking all related literature together, none of these studies considered the potential interaction effect of writing topics and L1 backgrounds on syntactic complexities in L2 writing through contrastive analysis grounded in corpus-driven approaches. The current study, therefore, fills this gap by systematically examining the interaction between within-genre topics and L1 backgrounds. A richer understanding of the interplay of these two variables would have significant implications for L2 writing literature and L2 pedagogy.

Literature Review

Computer-Aided Analysis for Writing

Recent advances in computational linguistics and information retrieval have allowed for computationally investigating measures of linguistic elaboration in assessing writing. Together, these advances allowed for the automated analysis of syntactic complexity, text cohesion, and text structure. Past studies in text analysis have heavily relied on the manual work of linguistic features or experts' intuition of written texts (Reid, 1992). As a result, researchers made broad speculations about the meaning of a small text selection. It was plausible that the limited size of the text that can be accessible may affect the result of the analyses (i.e., generability issues). In addition, the flaws of manual counts and the subjective nature of the intuitive approach often biased the analytical results. There was a strong need in the writing research for technology-supported analysis tools capable of analyzing texts at multidimensional levels.

Although computational tools are not required to compensate for weaknesses originating from traditional intuitive judgments, they are regarded as taking an initial step toward the quantitative evaluation of texts embedded in the scientific domain. Along with this trend in writing research, the characterization of syntactic complexity in second language writing requires many different measures. Indeed, computational tools may afford an innovative approach to writing assessment, feedback, and instruction.

For example, Long (2012) designed automated profiling for child language studies by incorporating the computation of Developmental Sentence Scoring (DSS) and Index of Productive Syntax (IPSyn) grounded in part-of-speech and morphological information. Likewise, Graesser et al. (2004) developed Coh-Metrix, an online toolkit developed to assess text difficulty and structure through the integrated use of lexicons, pattern classifiers, and syntactic parsers. This toolkit has investigated relationships between linguistic features and essay scores (Crossley & McNamara, 2012; Guo et al., 2013). As for Coh-Metrix, the text's syntactic complexity indices are the mean number of modifiers per noun phrase, the mean number of higher-level constituents per sentence, and the number of words appearing before the main verb of the main clause in the sentences of the text. However, Coh-Metrix has been developed for many years, but many features, including global cohesion and lexical sophistication indices, have not yet been integrated. In addition, these measures have been initially proposed and mainly referred to in L1 writing.

Meanwhile, the equivalent measures in SLA have not been systematically renovated. Syntactic complexity has been analyzed by adopting a diverse scope of indices. Because of the limited computational tools for automating syntactic elaboration analysis, numerous past studies employed a small number of measures for relatively small amounts of data. Norris and Ortega (2009) thus claimed that L2 writing researchers employ measures for global complexity, complexity by subordination, and complexity via phrasal elaboration and coordination.

To fill this gap, the L2 Syntactic Complexity Analyzer (L2SCA: Lu, 2011), a computational tool for automatic analysis of syntactic complexity, was used to generate syntactic complexity measures for the data. L2SCA needs written English in plain text format as input imported and exports 14 indices of syntactic complexity of the input data.

L2SCA was developed for L2 studies of advanced language proficiency and has been adopted mainly with tertiary-level writing texts.

Showing the reliability of the L2SCA in measuring syntactic complexity, Lu (2011) reported that seven out of 14 measures progressed linearly across levels of L2 writing quality. These measures involved the three traditional measures about the length of production (MLT, MLS, MLC), two measures about coordination, that is, coordinate phrases per clause (CP/C) and coordinate phrases per T-unit (CP/T), and two measures related to particular syntactic structures, that is, complex nominals per clause (CN/C) and complex nominals per T-unit (CN/T).

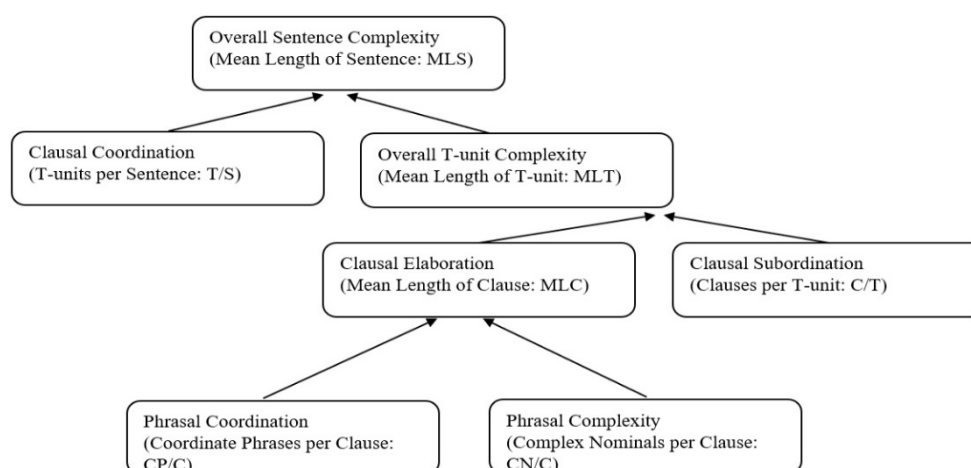
Conceptual Framework

The main theoretical framework in this study is the multidimensionality of syntactic complexity. Traditionally, the concept of syntactic complexity has been limited to the clause level in terms of linguistic complexity (Ortega, 2003). As a result, past studies have relied on some measurements based on relatively small data. However, with the development of corpus linguistics, which can analyze large amounts of data, the use of subordination or other clause-level complexity measures to investigate writing proficiency development has begun to raise questions. For example, Biber et al. (2011) suggested phrasal level complexity as a more meaningful measure of academic writing. In the same vein, Bulté and Housen (2014) investigated the usefulness of the complexity construct for studying L2 writing development. As a result, they reported significant phrasal complexity development and poor clausal subordination development. Similar evidence was found in Mazgutova and Kormos's (2015) short-term longitudinal data. Mazgutova and Kormos (2015) investigated the instructed development of syntactic complexity in a short period of 4 weeks. They found that intermediate-level L2 learners had higher levels of phrase-level syntactic complexity over a 4-week period.

This study is therefore based on Norris and Ortega's (2009) conceptualization of syntactic complexity as a multidimensional construct and the hierarchical relationships among the sub-constructs with a minor adaptation (Figure 1).

Figure 1

A multidimensional representation of syntactic complexity



Topics, L1 backgrounds, and Syntactic Complexity

In the writing field, topics may cause different task complexities that can impact the linguistic intricacies of writing and the accuracy of language production. Syntactic complexity studies on the topic effects have found that complex, familiar, and relevant topics lead to more extended clausal structures in L2 writing (e.g., Hinkel, 2002; Yang et al., 2015; Yoon, 2017).

For example, Hinkel's (2002) study that is embedded in topic effects on linguistic features found that Chinese ESL students showed increased syntactic complexity by using more nominalizations and infinitives when they wrote on a more relevant topic. In Hinkel (2002), the writing topic of one's academic major selection was assumed as most relevant for the students, and the topic of celebrities' wealth was as least relevant. In addition, Hinkel suggested that L2 writers used more causative subordination than L1 writers.

Building on Hinkel's (2002) discussion on topic relevance, Yoon (2017) also analyzed a corpus of 1198 argumentative essays produced by Chinese college-level students and found a more substantial topic effect on the syntactic complexity of writing compared to L2 proficiency. Yoon attributed the result to different levels of topic relevance between two different topics by indicating significant topic effects on the majority of syntactic complexity measures.

Similarly, Yang et al. (2015) examined the role of topics in syntactic features in argumentative essays written by ESL graduate students. Theorizing that higher syntactic complexity can be elicited by more cognitively demanding topics, their study demonstrated the relationship between topic and syntactic complexity with the different cognitive loads of topics. For example, in their study, the topic of physical appearance showed more elaboration, including coordinate phrases per clause and complex noun phrases. In contrast, the topic of careful planning displayed higher subordination, such as dependent clauses per t-units. They ascribed this finding to the varied syntactic demands caused by the different levels of causal reasoning for the two topics.

More recently, Atak & Saricaoglu (2021) found a strong effect of the death penalty topic on syntactic complexity development, which is attributable to its greater cognitive demands as a more impersonal topic than the other topics. In Atak and Saricaoglu (2021), three topics (i.e., the death penalty, online learning, and cell phones) were compared regarding the complexity developmental stages illustrated in argumentative essays written by intermediate-level L1 Turkish learners.

Meanwhile, one learner-related factor that has been understudied in syntactic complexity literature is L1 backgrounds (for exceptions, see Ai & Lu, 2013; Lu & Ai, 2015). For example, Ai and Lu (2013) found significant differences in four dimensions of syntactic complexity (i.e., length of the production unit, amount of subordination, amount of coordination, and degree of phrasal sophistication) between the writing of non-native speaker (NNS) students and native speaker (NS) students. However, Ai and Lu did not consider learners' L1 background as an independent variable as they acknowledged. In Lu & Ai (2015), when grouped by the EFL writers' L1 backgrounds, the NNS groups showed varied complexity patterns of difference from the NS group.

Collectively, these studies have offered valuable insights into the effects of within-genre topics and L1 backgrounds on writing quality and linguistic complexity. They have also expanded our understanding of the multidimensionality of linguistic complexity measures. In spite of their contribution to the literature on syntactic

complexity, this still leaves much room for further research because little is known about the interaction effect of topics and L1 backgrounds on syntactic complexities in L2 writing. To date, syntactic complexity studies that explore the interaction between topics and L1 backgrounds are scarce.

Research Questions

The present study, therefore, aims to investigate differences in the syntactic complexity in argumentative essays produced by college-level writers with different L1s (i.e., ESL and EFL), which are contrasted to the essays of NS professional writers as a reference, to understand how the interplay of writing topics and L1 backgrounds play out in argumentative essays. Also, this study investigates the effect of within-genre topics on L2 syntactic complexity. This study then seeks to address the following research questions.

RQ1: Is there an interaction between writing topics and L1 backgrounds?

RQ2: What differences are there between ESL/EFL learners' writing and that of NS writers in syntactic complexity?

RQ3: What effects does the writing topic have on the use of syntactic features by ESL/EFL writers?

Methodology

Corpus Data

The college-level essays were taken from the International Corpus Network of Asian Learners of English (ICNALE) (Ishikawa, 2009). The ICNALE-Written included timed argumentative essays from college-level Asian students from 10 countries (5400 essays) and native English speakers (400 essays).

Given that the writing conditions and learners' language proficiency were controlled in the ICNALE, ICNALE was validated as suitable for contrastive analysis. Therefore, the ESL/EFL student and the NS essays were extracted from ICNALE. Regarding writing conditions, participants were asked to write a response of 200 to 300 words on two topics within 40 to 80 min. The writing task expected participants to produce arguments/counter-arguments for two topics with logical reasoning and relevant examples.

The two topics were:

Part-time topic: "It is important for college students to have a part-time job."

Smoking topic: "Smoking should be completely banned at all the restaurants in the country."

As for language proficiency, the writers' proficiency in the ICNALE was evaluated based on internationally standardized tests, including TOEIC, TOEFL, IELTS, or the English vocabulary size test (VST; Nation & Beglar, 2007). First, the students were assigned to one of the four levels: A2 (TOEFL 56 and below), B1_1 (TOEFL 57–75), B1_2 (TOEFL 76–86), and B2+ (TOEFL 87 and above). Then, Ishikawa and his team

mapped these proficiency levels onto the CEFR proficiency bands using the official conversions proposed by Educational Testing Service (ETS).

The B2+ level, in which student writers had an equivalent TOEFL score of 87 and above, was adopted in the present study. Given that intermediate and low-level L2 writing tended to contain many grammatical and spelling errors to the extent that the credibility of the syntactic complexities was undermined, the advanced learners' essays were selected for data analysis. This study thus used 80 essays written by Korean EFL students as the EFL group, 80 essays written by Singaporean ESL students¹ as the ESL group at the B2+ level, and 80 essays written by L1 English professionals (i.e., English instructors and teachers) as the NS group.

Table 1 shows the overall size of each sub-corpus and the number of essays.

Table 1

Size of the corpus for this study

Topic	Group	Essays	Total words	Words		Sentences	
				Mean	SD	Mean	SD
PTJ	EFL	40	9555	238.87	34.23	15.22	3.66
	ESL	40	10389	259.72	33.22	10.99	2.41
	NS	40	8684	217.10	9.07	7.70	1.74
SMK	EFL	40	9143	228.57	28.14	16.22	4.48
	ESL	40	9727	243.17	31.09	11.77	2.64
	NS	40	8691	217.27	9.19	8.50	1.64
All		240	56,189				

Note. PTJ = part-time topic; SMK = smoking topic

Measurement of Syntactic Complexity

L2SCA was used as an automated tool to generate syntactic elaboration measures for the corpus data. L2SCA's reliability and validity have been recently confirmed by Polio and Yoon (2018).

In line with the theoretical justification to view syntactic complexity as a multidimensional construct (e.g., Casal & Lee, 2019; Lu, 2011; Yang et al., 2015), this study analyzes syntactic complexity based on global, clausal, and phrasal measures. Therefore, in this study, the L2SCA developed by Lu and his colleagues (Lu, 2011, 2017) was adopted to ensure a more comprehensive and multidimensional exploration of written syntactic complexity.

Seven syntactic complexity indices were selected from 14 indices of the L2SCA: two global, three clausal, and two phrasal indices. The selection of the target measures followed the criteria of "redundancy, validity, and construct distinctiveness" (Yoon, 2017, p. 134).

Table 2 shows these measures with their categories and definitions. These measures include the mean length of sentence (MLS), T-units per sentence (T/S), mean length of T-unit (MLT), mean length of clause (MLC), clauses per T-unit (C/T), coordinate phrases per clause (CP/C), and complex noun phrases per clause (CN/C).

¹ ICNALE adopts Kachru's (1985) categorization of English varieties. Singapore is classified as ESL based on ICNALE (Ishikawa, 2009).

Table 2*Target complexity measures*

Sub-construct	Measure	Formula
Global complexity	Mean length of sentence (MLS)	# of words / # of sentences
Global complexity	Mean length of T-unit (MLT)	# of T-units / # of T-units sentences
Clausal elaboration	Mean length of clause (MLC)	# of words / # of clauses
Clausal subordination	Clauses per T-unit (C/T)	# of clauses / # of T-units
Clausal coordination	T-units per sentence (T/S)	# of T-units / # of sentences
Phrasal coordination	Coordinate phrases per clause (CP/C)	# of coordinate phrases / # of clauses
Phrasal complexity	Complex nominals per clause (CN/C)	# of complex nominals / # of clauses

Note. # = number

Data Analysis

First, the corpus data was analyzed using the L2SCA, an automated measurement designed to examine the syntactic complexity of English texts discussed above. L2SCA generates frequency counts for structural units for each essay file, including words, sentences, verb phrases, clauses, dependent clauses, T-units, complex T-units, coordinate phrases, and complex nominals. At the same time, it creates seven indices of the selected syntactic complexity calculated using the frequency counts.

SPSS version 20.0 was then run further to report the primary quantitative results of the data. A two-way repeated-measures MANOVA was conducted with the topic as a within-subjects variable and L1s as a between-subjects variable. For main and interaction effects, the results of univariate analyses were examined thoroughly.

Regarding statistical analyses, the alpha level adjusted by the Bonferroni correction ($0.0071 = 0.05/7$) was adopted to decrease the possibility of Type I error. The magnitude of effects was examined in partial η^2 , a frequently employed size measure for studies including within-subject variables. Following Cohen's (2013) recommendation of the effect sizes, partial η^2 values of 0.0099, 0.0588, and 0.1379 were defined as small, medium, and large effects, respectively.

Results**Interaction Effects of Topic and L1s on Syntactic Complexity**

Table 3, as displayed in Appendix 1, shows the descriptive results for the seven indices for the part-time and smoking topics across different L1 groups. Compared to essays on the smoking topic, essays on the part-time topic showed a greater overall means (except for C/T and T/S of the EFL group), as can be observed in the higher values for MLS, MLT, MLC, C/T, T/S, CP/C, and CN/C across the different L1 groups.

As Table 4 presents, the two-way MANOVA results showed an interaction effect between topic and L1 backgrounds ($F(14,456) = 2.516$, $p = 0.002$, Wilks' $\Lambda = 0.862$). This means that patterns of topic effects on the three groups' syntactic elaboration are

likely to differ across their L1 backgrounds. The interaction effects of topic and L1 background were medium in size (partial $\eta^2 = 0.072$).

Notably, there was a significant interaction between the effects of topic and L1 background on CP/C (coordinate phrases per clause) that indicates phrasal coordination at the local level ($F = 6.085$, $p = .003$, partial $\eta^2 = 0.049$).

Table 4
Interaction effects of topic and writers' L1 backgrounds

		Topic X L1		
		F	P	Partial η^2
Global level	MLS	0.645	0.526	0.005
Global level	MLT	0.481	0.619	0.004
Clausal elaboration	MLC	0.414	0.661	0.004
Clausal subordination	C/T	0.878	0.417	0.007
Clausal coordination	T/S	0.199	0.820	0.002
Phrasal coordination	CP/C	6.085	0.003*	0.049
Phrasal complexity	CN/C	0.015	0.985	0.000
Wilks' Lambda		2.516	0.002	0.072

Note. *p-value is significant with the Bonferroni correction ($p < .05/7$ or $.0071$)

MLS = Mean length of sentence; MLT = Mean length of T-unit; MLC = Mean length of clause; C/T = Clauses per T-unit; T/S = T-units per sentence; CP/C = Coordinate phrases per clause; CN/C = Complex nominals per clause

Tables 5 and 6 present the simple main effects of each independent variable on the syntactic complexity features. Regarding the simple main effects of different L1s, as shown in Table 5, the univariate analyses indicated that all seven syntactic complexity measures were significantly influenced. Most measures showed large effect sizes ranging from 0.167 to 0.512.

Notably, at the global complexity level, as indicated by MLS (Mean length of sentence), L1 had the most significant effect on the length of production unit (partial $\eta^2 = .512$). On the other hand, at the local level, as indicated by T/S (T-units per sentence), L1 exerted the second most significant effect on the clausal coordination (partial $\eta^2 = .422$).

Table 5
Univariate analyses of L1 effects on seven syntactic complexities

		L1 background		
		F	P	Partial η^2
Global level	MLS	122.74	0.000*	0.512
Global level	MLT	50.57	0.000*	0.302
Clausal elaboration	MLC	60.26	0.000*	0.340
Clausal subordination	C/T	47.30	0.000*	0.288
Clausal coordination	T/S	85.48	0.000*	0.422
Phrasal coordination	CP/C	23.38	0.000*	0.167
Phrasal complexity	CN/C	42.40	0.000*	0.266
Wilks' Lambda		32.66	0.000*	0.501

Note. *p values are significant with the Bonferroni correction ($p < 0.05/7$ or 0.0071)

With regard to topic effects, the univariate analyses indicated that five out of seven complexity measures were significantly influenced and that the topic effect on clausal elaboration (MLC) was particularly large in size (partial $\eta^2 = .107$). Table 6 shows that these five measures included MLS, MLT, MLC, CP/C, and CN/C, whereas clausal subordination (C/T) and clausal coordination (T/S) were the measures with no statistically significant topic effect. Furthermore, of these five complexity measures with statistical significance, all measures showed higher values in the part-time topic than in the smoking topic.

Table 6
Univariate analyses of writing topic effects on seven syntactic complexities

		Topics		
		F	P	Partial η^2
Global level	MLS	16.09	0.000*	0.064
Global level	MLT	14.43	0.000*	0.058

Clausal elaboration	MLC	27.96	0.000*	0.107
Clausal subordination	C/T	0.01	0.895	0.000
Clausal coordination	T/S	0.05	0.822	0.000
Phrasal coordination	CP/C	20.27	0.000*	0.080
Phrasal complexity	CN/C	13.30	0.000*	0.054
Wilks' Lambda		5.13	0.000*	0.136

*p values are significant with the Bonferroni correction ($p < .05/7$ or $.0071$)

Differences in Syntactic Complexities of EFL, ESL, and NS Groups

Tukey's HSD analyses showed that, at the global complexity levels, overall sentence complexity measured by MLS was significantly different between the Korean EFL group and the Singaporean ESL group (M: 15.74 vs. 23.13, $p < 0.0071$) and the Korean EFL group and the NS group (M: 15.74 vs. 27.89, $p < 0.0071$), and between Singaporean ESL and the NS groups (M: 23.13 vs. 27.89, $p < 0.0071$). In addition, overall T-unit complexity attained by MLT was significantly different between the Korean EFL group and the Singaporean ESL group (M: 14.63 vs. 20.46, $p < 0.0071$) and the Korean EFL group and the NS group (M: 14.63 vs. 20.18, $p < 0.0071$), but not between Singaporean ESL group and NS group (M: 20.46 vs. 20.18, $p = 0.898$).

As with the clausal level complexity, Tukey's HSD analyses showed that clausal elaboration measured by MLC was statistically significantly different between the Korean EFL group and the Singaporean ESL group (M: 8.61 vs. 11.09, $p < .0071$) and the Singaporean ESL group and the NS group (M: 11.09 vs. 8.98, $p < .0071$), but not between the Korean EFL group and the NS group (M: 8.61 vs. 8.98, $p = 0.284$). Furthermore, the clausal subordination attained by C/T was statistically significantly different between the NS group and the Korean EFL group (M: 2.26 vs. 1.69, $p < .0071$), and the NS group and the Singaporean ESL group (M: 2.26 vs. 1.86, $p < .0071$), but not between the Korean EFL group and Singaporean ESL group (M: 1.69 vs. 1.86, $p = 0.014$). In addition, Tukey's HSD analyses showed that clausal coordination measured by T/S was significantly different between the Korean EFL group and the NS group (M: 1.08 vs. 1.40, $p < 0.0071$) and the Singaporean ESL group and NS group (M: 1.13 vs. 1.40, $p < 0.0071$), but not between EFL and ESL groups (M: 1.08 vs. 1.13, $p = 0.139$).

Regarding the phrasal levels, phrasal coordination measured by CP/C was significantly different between the Korean EFL group and the Singaporean ESL group (M: 0.14 vs. 0.25, $p < 0.0071$) and the Singaporean ESL group and the NS group (M: 0.25 vs. 0.15, $p < 0.0071$), and but not between EFL and NS groups (M: 0.14 vs. 0.15, $p = 0.711$). In addition, noun phrasal complexity measured by CN/C was significantly different between the Korean EFL group and the Singaporean ESL group (M: 0.91 vs.

1.33, $p < 0.0071$) and the Singaporean ESL group and the NS group (M: 1.33 vs. 1.06, $p < 0.0071$), and between EFL and NS groups (M: 0.91 vs. 1.06, $p < 0.0071$). Figures 2-4 below briefly show the research results.

Figure 2

Mean differences in MLS, MLT, and MLC measures

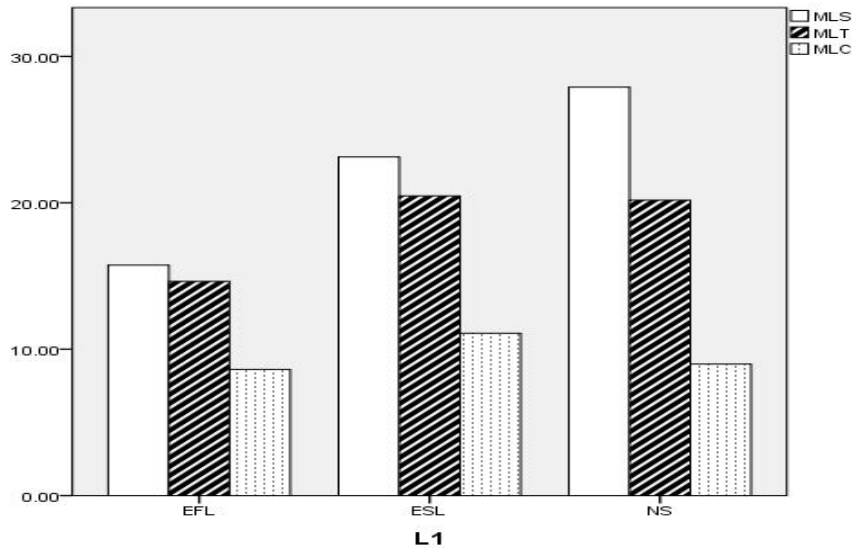


Figure 3

Mean differences in C/T and T/S measures

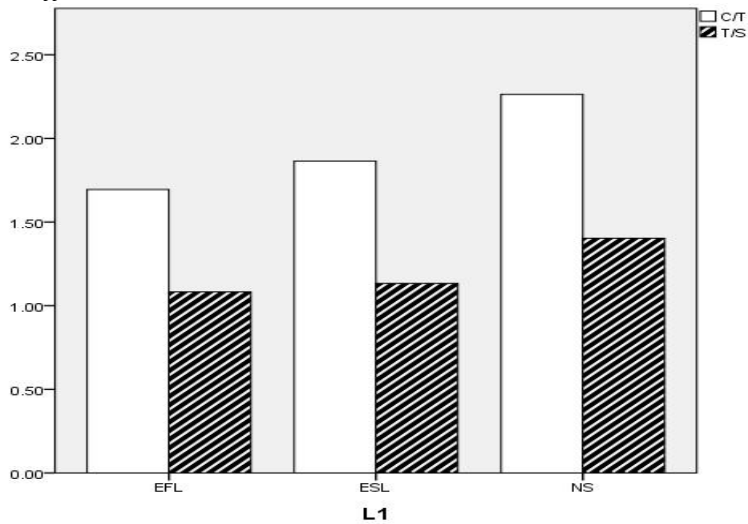
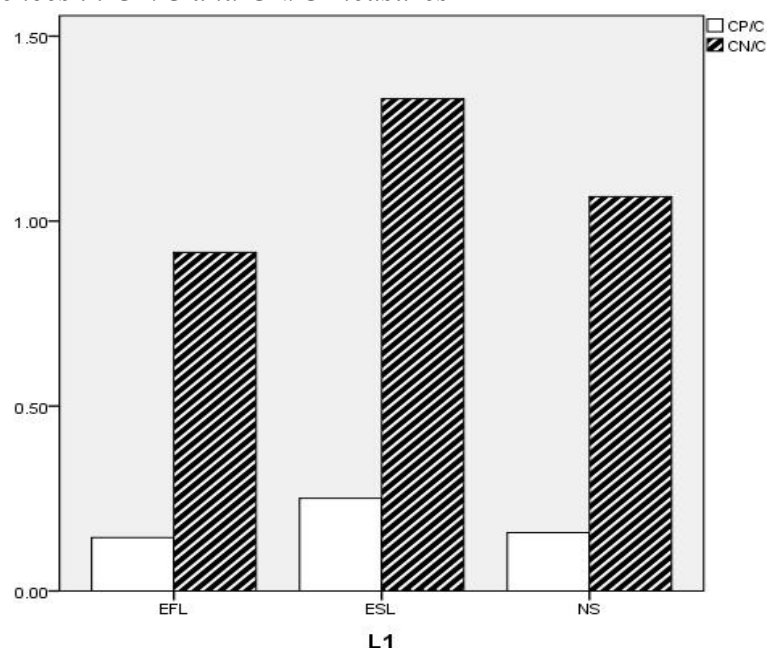


Figure 4
Mean differences in CP/C and CN/C measures



Patterns of Syntactic Complexity Variation by Writing Topics

Post-hoc comparisons for the syntactic complexity features used in the essays for the two writing topics are summarized in Table 7. The *t* statistics and the *p* values are the testing results for the topic comparison for each complexity measure, and Cohen's *d* is employed to obtain the effect sizes for the comparison between two means. Following Cohen (2013), *d* values of 0.2, 0.5, and 0.8 are considered small, medium, and large, respectively.

Table 7
Follow-up comparisons for the syntactic complexity by writing topics

Measures	Group	PTJ M(SD)	SMK M(SD)	<i>t</i>	<i>p</i>	Cohen's D
MLS	EFL	16.51 (4.15)	14.97 (4.09)	2.77	0.008	0.37
	ESL	24.66 (5.12)	21.60 (5.22)	4.10	0.000*	0.59
	NS	29.44 (6.25)	26.35 (4.47)	2.78	0.008	0.56
MLT	EFL	15.39 (4.15)	13.88 (4.66)	2.70	0.010	0.34
	ESL	21.84 (3.98)	19.09 (3.58)	4.56	0.000*	0.72
	NS	21.09 (4.30)	19.26 (4.03)	2.30	0.027	1.26
MLC	EFL	9.25 (1.85)	7.97 (1.24)	5.68	0.000*	0.81

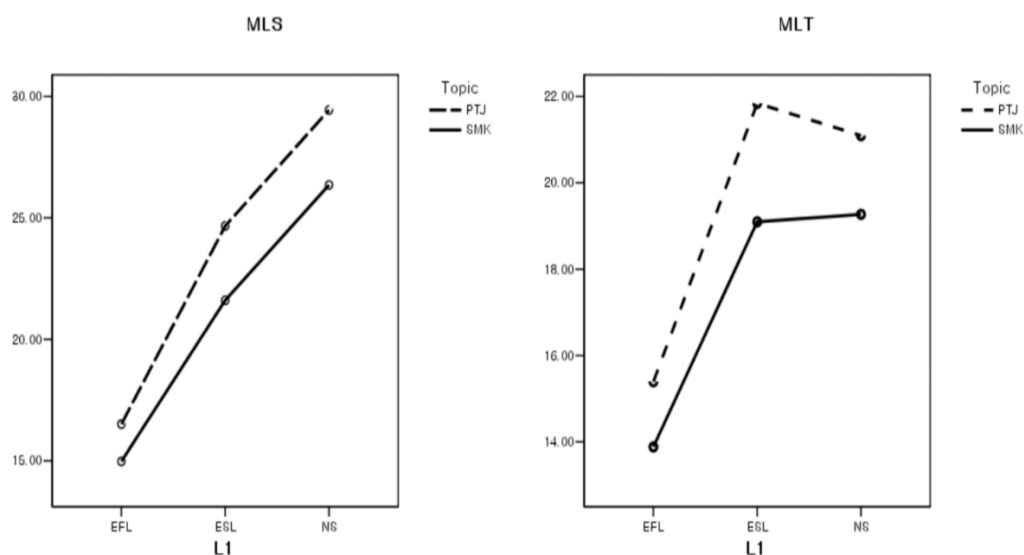
	ESL	11.60 (1.97)	10.58 (1.44)	2.86	0.007*	0.59
	NS	9.40 (1.26)	8.56 (1.28)	3.06	0.004*	0.66
C/T	EFL	1.66 (0.26)	1.72 (0.36)	-1.22	0.229	0.19
	ESL	1.91 (0.36)	1.81 (0.34)	1.42	0.163	0.28
	NS	2.26 (0.47)	2.27 (0.42)	-0.05	0.953	0.02
T/S	EFL	1.07 (0.09)	1.08 (0.08)	-0.61	0.544	0.11
	ESL	1.14 (0.14)	1.13 (0.15)	0.07	0.941	0.06
	NS	1.41 (0.24)	1.39 (0.21)	0.54	0.591	0.09
CP/C	EFL	0.17 (0.10)	0.11 (0.07)	3.26	0.002*	0.69
	ESL	0.31 (0.16)	0.18 (0.09)	4.20	0.000*	1.00
	NS	0.16 (0.08)	0.15 (0.09)	0.30	0.764	0.12
CN/C	EFL	0.98 (0.34)	0.84 (0.25)	2.63	0.012	0.46
	ESL	1.39 (0.31)	1.26 (0.29)	2.24	0.031	0.43
	NS	1.13 (0.27)	0.99 (0.24)	2.60	0.013	0.54

*p values are significant with the Bonferroni correction ($p < 0.05/7$ or 0.0071).

Compared to essays on the smoking topic, essays on the part-time topic, in general, showed a higher amount of overall length of the production unit at the global level (see Figure 5). Post-hoc analyses showed that the Singaporean ESL student group showed a significantly higher amount of elaboration at the global level in essays on the part-time topic, as can be observed in the higher values for MLS ($t = 4.10$, $p = 0.000$, $d = 0.59$) and MLT ($t = 4.56$, $p = 0.000$, $d = 0.72$). On the other hand, the Korean EFL student group and the NS group displayed no significant difference in their use of global complexity levels, including MLS (EFL: $p = 0.008$, $d = 0.37$; NS: $p = 0.008$, $d = 0.56$) and MLT (EFL: $p = 0.010$, $d = 0.34$; NS: $p = 0.027$, $d = 1.26$) across the topics.

Figure 5

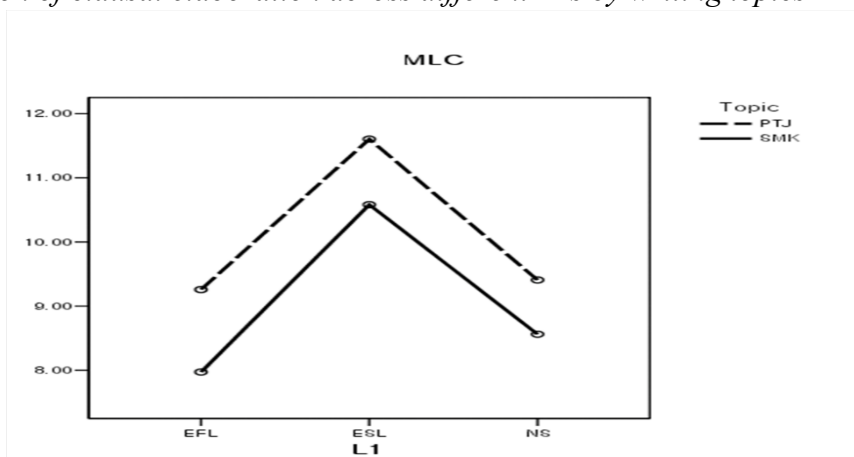
Variations of overall sentence complexity and overall T-unit complexity across different L1s by writing topics



In terms of elaboration at the clausal level, as shown in Figure 6, all three groups showed significantly higher values for MLC in the part-time topic (EFL: $p = 0.000$, $d = 0.81$; ESL: $p = 0.007$, $d = 0.59$; NS: $p = 0.004$, $d = 0.66$).

Figure 6

Variation of clausal elaboration across different L1s by writing topics

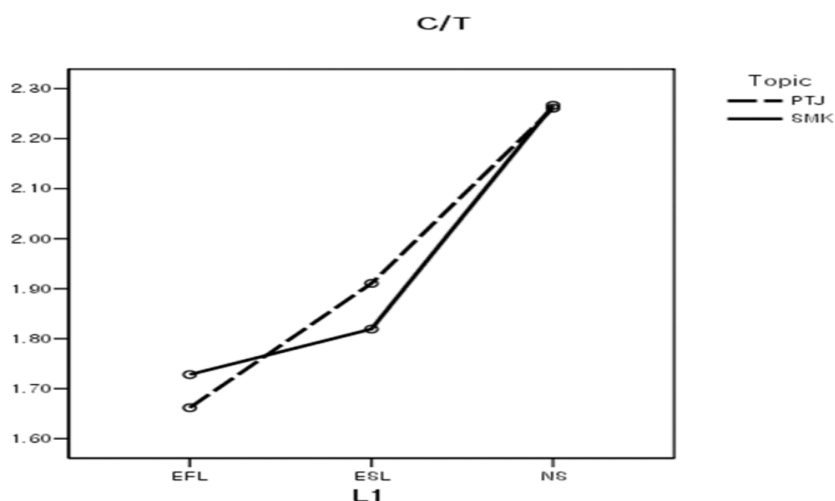


Interestingly, the Singaporean ESL student group exhibited the highest T-unit complexity ($M = 21.84$) as measured by MLT for the part-time topic and the highest elaboration at the finite clausal level as measured by MLC (PTJ $M = 11.60$; SMK $M = 10.58$) for both topics among the three groups. This finding corroborates Ortega's (2003) claim that more linguistic complexity does not entirely signal higher proficiency or better performance because of the potential effects of register, genre, and task.

In terms of subordination at the finite clausal level, no group displayed a significant difference in the use of C/T by writing topics (EFL: $p = 0.229$, $d = 0.19$; ESL: $p = 0.163$, $d = 0.28$; NS: $p = 0.953$, $d = 0.02$). Figure 7 shows the variation of clausal subordination across the three groups by writing topics.

Figure 7

Variation of clausal subordination across different L1s by writing topics



Similarly, as presented in Figure 8, there were no statistical differences in clausal coordination as measured by T/S for essays on the two topics (EFL: $p = 0.544$, $d = 0.11$; ESL: $p = 0.941$, $d = 0.06$; NS: $p = 0.591$, $d = 0.09$). There were, however, statistical differences in phrasal coordination as measured by CP/C across the writing topics. In terms of CP/C, the EFL group and the ESL group showed significant topic differences (i.e., higher values of CP/C in the part-time topic; EFL: $p = 0.002$, $d = 0.69$; ESL: $p = 0.000$, $d = 1.00$). However, the NS group did not change their use of CP/C across the two topics ($p = 0.764$, $d = 0.12$).

Figure 8

Variation of clausal coordination and phrasal coordination across different L1s by writing topics

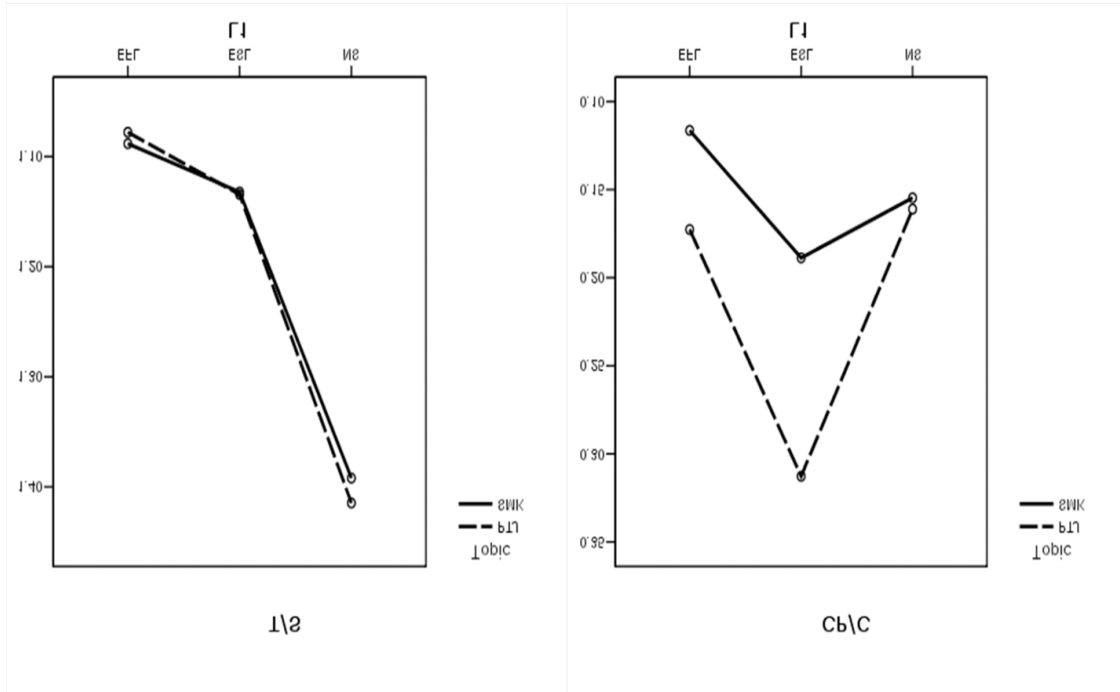
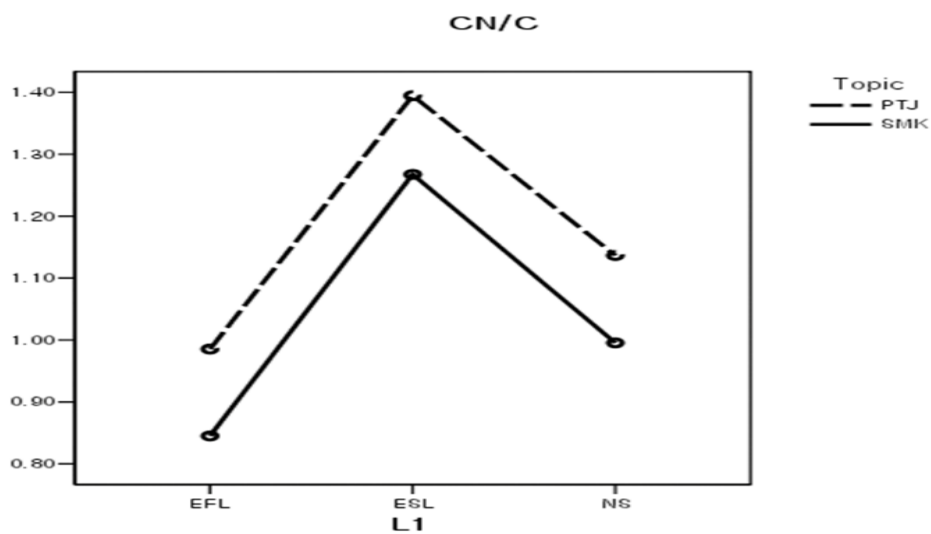


Figure 9 shows that there were no statistical differences in phrasal sophistication for essays on the two topics. The three groups displayed no significant difference in their use of phrasal sophistication feature as measured by CN/C (EFL: $p = 0.012$, $d = 0.46$; ESL: $p = 0.031$, $d = 0.43$; NS: $p = 0.013$, $d = 0.54$).

Figure 9

Variation of phrasal sophistication across different L1s by writing topics



Overall, essays on the part-time topic presented a significantly higher amount of elaboration at the finite clause level, which may be attributable to the overuse of coordinate phrases and complex noun phrases. This result suggests that certain topics may elicit more use of particular syntactic complexity features in L2 writing.

Moreover, Appendix 2 shows specific instances of coordinate phrases and the complex nominals used in part-time and smoking topic essays, respectively. The first two essays are taken from the part-time topic essays of the EFL and ESL groups, whereas the remaining two are taken from the smoking topic essays of the two groups. In Extracts 1 and 2, coordinate phrases and complex noun phrases were frequently employed, providing descriptions and lengthening clauses. However, the use of coordinate phrases was relatively limited on the smoking topic, as shown in Extracts 3 and 4.

Discussion

This study explored syntactic complexities in argumentative essays produced by advanced EFL and ESL student writers compared to NS professionals. This study drew on 240 argumentative essays from the ICNALE, thereby controlling the writing conditions and the English language proficiency of the student writers. The EFL and ESL students' essays were compared with those of NS writers to understand further how within-genre topics and different L1s can influence the written texts produced.

First, there was a significant interaction effect between topic and L1 background, particularly on phrasal coordination as measured by CP/C. This indicates that patterns of topic effects on the three groups' phrasal coordination differ across their L1 backgrounds. However, the interaction effect size was generally smaller than that of each of their main effects (topic and L1 background, respectively). Based on the results of effect sizes, L1 backgrounds influenced overall syntactic complexity to a greater extent than writing topics.

This finding partially concurs with Yoon (2021). While investigating the effects of topic, L1 background, and L2 proficiency on the amount of interactional metadiscourse shown in EFL argumentative essays, Yoon (2021) found significant interaction effects between topic and L1 background on the use of hedges, attitude markers, self-mentions, and directives, indicating that topic effects on these metadiscourse markers were varied by EFL students' L1 backgrounds. In a similar way, the size of the interaction effects tended to be smaller than that of each of their main effects.

This finding is also in line with the previous studies that have shown that phrasal complexity is more characteristic of advanced academic writing (e.g., Lu, 2011; Norris & Ortega, 2009; Ravid & Berman, 2010; Staples et al., 2016; Taguchi et al., 2013). In advanced writing, a more significant increase in elaboration at the phrase level has been noticed (Kyle & Crossley, 2018; Lu, 2011; Norris & Ortega, 2009). The prior studies reported an overall upward inclination for complex phrases in academic writing throughout their development in a longitudinal approach where changes in complexity features are followed up. For example, Norris and Ortega (2009) stated that subclausal or phrasal complexity indices work better for measuring language development at an advanced level. In their corpus-based study comparing grammatical features in spoken and written discourse, Biber et al. (2011) also found that clausal level measures reflect the complexities of spoken language while phrasal level measures represent the

complexities of academic writing. The result of the present study then confirms that the sole reliance on the amount of clausal subordination to describe writing proficiency is problematic.

Next, the quantitative analysis showed significant main effects of topic and L1. Overall, the main effects of topic and L1 background were large. Regarding simple main effects, all seven complexity measures were significantly affected by L1 backgrounds with large effect sizes, showing the practical meanings. Concerning topic effects, five out of the seven complexity measures were significantly influenced by the writing topic. The topic effect on MLC was large in size (partial $\eta^2 = 0.107$), and those on MLS, MLT, CP/C, and CN/C were moderate in size (the range of partial η^2 from 0.054 to 0.080). These complexity measures with statistical significance showed higher mean values in the part-time topic than in the smoking topic. The present results are partially consistent with the findings shown in Hinkel (2009). By investigating Chinese, Japanese, and Korean EFL students' writing, Hinkel claimed that the topic affected their use of modal verbs. The study showed that median frequency rates of modal verbs were influenced by the writing topic. However, some topics greatly impacted a particular L1 group (e.g., Japanese students' overuse of ability modals).

Also, this finding supports topic effects that their relevance can vary to writers' own experiences (Hinkel, 2002; Lo & Hyland, 2007; Yoon, 2017). For example, Yoon (2017), who focused on the essay writing produced by Chinese EFL learners in his study, suggested that the part-time topic is more closely related to L2 writers' experience as college students than the smoking topic. Yoon (2017) further discussed that a part-time job topic seems more relevant to college-level students than a smoking topic, leading student writers to produce more complex language and more extended writing. So then, in this study, the NS group, as English teachers or instructors, might feel a relatively small gap in topic relevance and show little differences in syntactic complexities between the two topics.

Interestingly, no group showed a significant difference in the use of C/T pertaining to clausal subordination by writing topics. Topic influenced clausal subordination with the small size of effect. This finding is aligned with previous research (Bi & Jiang, 2020) showing that C/T is useful for measuring the writing proficiency of less proficient learners in assessing L2 writing. This may not be the case for advanced learners like this study. This finding thus confirms the previous research claiming that different complexity indices need to be used to evaluate the writing proficiency of learners at diverse stages (Bi & Jiang, 2020).

Comparing the EFL and NS groups on both topics, it was found that NS writings are generally more complex than the EFL writings in most aspects of the length of production units, sentence complexity, clausal subordination, clausal coordination, and phrasal complexity. As for the comparison of the ESL and NS groups, the ESL writings appeared more complex than the NS writings in terms of overall T-unit complexity, elaboration at clause level, phrasal coordination, and phrasal complexity.

Regarding the length of production units, the NS group did not consistently produce more extended production units than both EFL and ESL groups. While the EFL group showed significantly negative differences from the NS group across the indices of MLS, MLT, and MLC, the ESL group showed significantly positive differences from the NS group in terms of MLT and MLC. Also, the ESL group exhibited the highest numbers

of CP/C and CN/C, which suggests that the ESL group tended to write a greater number of complex syntactic structures, including coordinate phrases and complex noun phrases.

These results are aligned with Lu and Ai (2015), pointing out that learner writers with different L1s, even for the same proficiency levels, may not develop in similar ways in all syntactic features. Also, Lu and Ai noticed that advanced writers from certain L1s have a tendency to produce longer and more complex sentences in English compared to writers from other L1s (including English L1). Also, these results corroborate Ortega (2003) 's statement that it is misguided to unconditionally identify more linguistically complex writing with expert writing, thereby validating the development of composing expertise as a complex domain that goes beyond simply achieving the linguistic abilities of L2 writers.

Conclusion and Limitations

This study investigated the effect of within-genre topics on syntactic elaboration in argumentative essays written by EFL and ESL college students, contrasted with the essays of NS writers. This study also revealed an interaction effect between one task variable (i.e., within-genre topics) and one learner variable (i.e., L1 background). The interaction effect was found to be significant, particularly at the phrasal complexity level, that is, coordinate phrases per clause. The present study, comparing student and professional writers of different L1 backgrounds, found significant statistical differences in the use of the global and local complexity levels. Given that all the seven complexity measures were significantly affected by L1 backgrounds with large effect sizes, this study found a more substantial influence of L1 backgrounds on the syntactic complexity of writing in comparison to writing topics. Regarding the effect of writing topic, a within-genre prompt variable, this study interpreted topic effects in terms of their relevance to writers' life experiences rather than different levels of reasoning demands between topics.

Although this study provides important findings contributing to the L2 syntactic complexity literature, this study is not without its limitations. First, this study, grounded in prior studies, considered global-level and local-level complexity that employ the mean length of sentence and mean length of T-unit, clausal coordination, clausal subordination, phrasal coordination, and phrasal sophistication. Despite their usefulness in comparing writing proficiencies, they are not entirely sufficient in that they do not display the specific linguistic structures shown in writing. Therefore, future studies should pursue a fine-grained approach that can measure the frequency of specific linguistic structures in measuring phrasal complexity and thus detect subtle differences in specific structures between L1 and L2 writing.

Second, lexical variety has also been an essential feature of distinguishing L1 and L2 writing, along with syntactic complexity. Previous studies found that, in comparison to L1 professional writers, L2 student writers used less lexical variety within particular syntactic features (Aktas & Cortes, 2008; Callies, 2013). Follow-up studies are warranted that adopt a lexico-grammatical approach to explore the intersection of grammar and lexicon in student writing.

Third, this study examined the significant differences in syntactic complexities from a quantitative approach focused primarily on the frequency of complexity features in each text. However, this quantity-based analysis may fail to provide a complete picture

of learners' grammatical competence, so it would be important to identify what types of syntactic features (within each syntactic category) are prevalent in student writing and how the use of such frequently used features varies with L1 backgrounds.

Finally, while the discussion of topic effects on syntactic elaboration provides insights into teaching and assessment, they should be accepted with caution because this corpus-informed study was based only on the two topics with the lens of topic relevance, without systematic manipulation of topic differences.

The results of this study shed light on the differentiated syntactic characteristics of academic writing taken from advanced ESL/EFL student writers. Together, this study provides additional implications regarding writing pedagogy and research methods. As a pedagogical implication, writing teachers' awareness of the patterns revealed in this study can facilitate a richer understanding of varied syntactic complexity that may be noticed in writings from their students in the classroom. The topic can also be of great importance, particularly in the context of writing assessments, to be considered in advance because the writing topic is regarded as a factor leading to changes in syntactic elaboration, especially in the context of timed writing. It is important to note that the prompt's wording can condition student writers' essays, given that they tend to respond to the discursive demands of the writing tasks (Aull, 2017). Because certain topics may elicit more complex language, instructors need to pay attention to topics in designing their lessons in the writing classroom.

As a methodological implication, this corpus-based analysis suggests that the fine-grained approach allows for discovering L1 influences on specific linguistic features, thereby providing a more comprehensive characterization of syntactic elaboration and thus locating syntactic features for in-depth cross-linguistic investigation. In addition, future research with carefully elaborated prompts and an extended time limit will yield more generalizable findings.

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Appendix 1

Table 3

Mean values and standard deviations of syntactic complexities by writing topic and L1 backgrounds

Measures	Topic	EFL		ESL		NS		Total	
		M	SD	M	SD	M	SD	M	SD
MLS	PTJ	16.51	4.15	24.66	5.12	29.44	6.25	23.54	7.47
	SMK	14.97	4.09	21.60	5.22	26.35	4.47	20.97	6.55
MLT	PTJ	15.39	4.15	21.84	3.98	21.09	4.30	19.44	5.02

	SMK	13.88	4.66	19.09	3.58	19.26	4.03	17.41	4.79
MLC	PTJ	9.25	1.85	11.60	1.97	9.40	1.26	10.08	2.01
	SMK	7.97	1.24	10.58	1.44	8.56	1.28	9.03	1.72
C/T	PTJ	1.66	0.26	1.91	0.36	2.26	0.47	1.94	0.45
	SMK	1.72	0.36	1.81	0.34	2.26	0.42	1.93	0.44
T/S	PTJ	1.07	0.9	1.13	0.14	1.41	0.24	1.20	0.22
	SMK	1.08	0.08	1.13	0.15	1.39	0.21	1.20	0.20
CP/C	PTJ	0.17	0.10	0.31	0.16	0.16	0.08	0.21	0.13
	SMK	0.11	0.07	0.18	0.09	0.15	0.09	0.15	0.09
CN/C	PTJ	0.98	0.34	1.39	0.31	1.13	0.27	1.17	0.35
	SMK	0.84	0.25	1.26	0.29	0.99	0.24	1.03	0.31

Note. MLS = Mean length of sentence; MLT = Mean length of T-unit; MLC = Mean length of clause; C/T = Clauses per T-unit; T/S = T-units per sentence; CP/C = Coordinate phrases per clause; CN/C = Complex nominals per clause

Appendix 2

Bold: coordinate phrases

Italicized: complex noun phrases

Extract 1 (EFL-PTJ-219-B2)

These days college students are busy doing both of **study and part time job**. Students have burden on a lot of **assignments and expensive tuition fee**. Especially, it is *a big burden* for both **students and parents** to make *the tuition fee*. Doing a part time job is important to college student for *three main reasons*: **learn** the society, **make personal relations and be independent**. First, students can experience how the society works. When they graduate, most of students get *their own job*. The part time job gives them *a great chance to work with workers and know the atmosphere*. Hence, students can know the society different from campus life. Second, students can make *more personal connections* among people by doing the part time job. They have *a great chance to meet other college students* who do the part time job. In addition, students can have *a wide acquaintance with full-time workers*. Finally, students can be independent. They **get the salary and deposit it** as part of tuition. Therefore students don't have to rely on their parents. Also, the salary can be used as *pocket money*. For these reasons, it is recommendable for students to have a part time job.

Extract 2 (ESL-PTJ-035-B2)

Having a part-time job while one is a student can be beneficial to **him or her**. Firstly, **he or she** is able to earn some money using **his or her own effort**. Secondly, it

does not take up *too much responsibility nor time*, and in *ideal situations* will not distract the too much from **his or her main occupation** as a student. Moreover, one is able to make friends in **his or her working circle**, and understand how to navigate the *working world after graduation*. Many students take up *tuition assignments* which are ad-hoc and easy to manage around *their time-table*, while others seek jobs **during the week-ends or at night**, after their lessons. Part-time jobs are usually popular with people who **have other more serious commitments, but have some spare time** in which they would **like a change in environment, or earn some money**. Personally, I have worked as a packer at *a florist's packing hampers* during the Chinese New Year holidays. Although I **was required** to work overtime **and was given minimal wages**, I look back on *those days with fondness* now remembering **my friendly co-workers and my pride** in my first (albeit low) salary. I would highly encourage students to try out *a variety of part-time jobs*, so as to be able to try out *different experiences*, rather than opting for **higher-paying, but boring jobs**.

Extract 3 (EFL-SMK-128-B2)

I don't think it is a *good idea* to ban smoking in all restaurants. Well, some people might argue that *all public places* should ban smoking because it affects non-smokers too through second-hand smoking. However, I think differently. I think *public places* should be places where all people can enjoy their freedom. Restricting smokers to smoke would be depriving their freedom. On the other hand, some people argue that public places are for all and that by allowing smoking, it is upholding *only one side* of the argument. This is no doubt true, too. By allowing smoking in public places, non-smokers are directly affected by the smoke. They inhale the smoke and this can be more harmful than smoking cigarette themselves. It is understandable why some people support *prohibition of smoking in public places*. But, if we ban smoking, that would only be considering *non-smokers side* too. The smokers are deprived of *their freedom in public places*. Therefore, it is necessary that we find *a way to satisfy both sides*. So, for a perfect solution, I think there needs to be a compromise. One of them could be dividing the restaurant into **non-smoking area and smoking area**. By doing this, smokers can **go to a smoking section and enjoy their freedom**, while non-smokers can sit in *a non-smoking section* where they won't get affected by it. Through this way, it can uphold *both sides of the argument*, and it is fair enough.

Extract 4 (ESL-SMK-066-B2)

Smoking is a habit that people pick up over time, and *most of the time* they do not drop the habit so easily even if they wanted to. Banning smoking completely at restaurants would mean *clean air for the restaurant patrons*. So is this a **good thing or a bad thing**? Banning smoking completely in restaurants would mean that non-smokers would be able to walk **in and out of the restaurant**, without worrying about smoke polluting the air they breathe which would allow them to enjoy *their meal in peace*. However, this would mean that smokers would no longer be able to **get their fix and relax** after a meal. Doing this might actually deter smokers from eating at restaurants because they can't fully enjoy themselves while eating there. However, because smoking is a choice, I feel that if smoking were to be banned completely in all restaurants, smokers would have to **live**

with the decision and accept that their habit is not something everyone condones. Also, for the sake of everybody else who patronizes the restaurant, banning smoking completely, I feel, would be **acceptable and fair** to non-smokers. For the sake of the *non-smoker's health*, it should be banned at all restaurants. If smokers need to smoke, then they can walk *outside of the restaurant* to do it, away from people who wish to breathe fresh air.