

Original Paper

A Study on Syntactic Complexity and Topic Difference Influence in Second Language Writing Based on Dependency

Treebank

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Abstract

Using Stanford parser as a tool, taking 1840 articles on two topics by 920 English learners of four levels after random selection as the research corpus, this study attempts to explore the development trend of syntactic complexity of learners of different levels and what influence divergent topic can have on it. Results show that multi-level learners generally prefer adverbial clauses (advcl) and complement clauses (ccomp) to relative clauses (acl: recl); adjective modifiers (amod) are the best in distinguishing the level of English learners, which can be used as an important basis for judging the level of L2; in addition, different topics of the same task type have no significant effect on L2 learners' syntactic complexity. It can be concluded that most syntactic complexity measures at the clause and phrase level show a non-linear development trend. Based upon the findings, implications are provided for English textbook development and English pedagogical practices.

Keywords

second language writing, syntactic complexity, stanford parser, dependency treebank

1. Introduction

Syntactic complexity, also known as syntactic maturity, refers to the sophistication and variation of syntactic structures exhibited in spoken or written language (Lu, 2011; Ortega, 2003; Pallotti, 2015). It is usually considered as an important multi-dimensional indicator to measure learners' language level and describe the trajectory of language development (Wolfe-Quintero et al., 1998; Bao, 2009). In the field of second language acquisition research, learners' second language proficiency and characteristics of language development at different stages are usually reflected in the syntactic complexity to a certain extent. In other words, the change in syntactic complexity measures showcases the enhancement or

setback of the language ability for second language learners, especially the syntactic ability, which is one of the main indicators to measure the quality of second language writing (Bulté & Housen, 2014). Therefore, syntactic complexity constitutes a key construct in second language writing research (Wolfe-Quintero et al., 1998; Lu & Ai, 2015; Qin & Wen, 2007; Bao, 2009; Lei, 2017).

However, due to differences in collected corpora, research methods as well as experiment designs, there are still disputes on the classification and validity of various syntactic complexity measures and also the relationship between them. In view of this, based on the dependency syntactic analysis provided by the Stanford Parser, this study randomly selects 1840 essays from The ICNALE Written Essays V2.4 corpus as the research object. It is aimed to discover comparative differences in the syntactic complexity of second language learners at different CEFR levels from a developmental perspective, and to explore the effect that topic differences could have on syntactic complexity, so as to serve as a practical reference for second language acquisition research and pedagogy, foreign language writing teaching and writing testing.

2. Related Literature

Earlier research on syntactic complexity in second language writing began in the late 1970s, and the exploration over the past 40 years has mainly focused on the following three aspects: first, different dimensions of syntactic complexity, syntactic complexity measures and their reliability and validity; second, the relationship between syntactic complexity and language proficiency, and how syntactic complexity develops over time; third, the influence of other factors on syntactic complexity, such as topic, writing style, task type, scoring method, and learners' first language background.

Researchers have tried to employ various indicators to manifest syntactic complexity (Wolfe-Quintero et al., 1998; Ortega, 2003; Norris & Ortega, 2009; Jiang et al., 2019; Vandeweerd et al., 2021; Ziaieian et al., 2022), and grouped those measures into four dimensions: length of production unit, amount of subordination, amount of coordination and degree of phrasal sophistication (Lu, 2011; Bulté & Housen, 2014). Although traditional large-grained measures such as the mean length of sentence are effective in assessing L2 writing proficiency, they cannot accurately reflect the syntactic characteristics in L2 writing or the nature of L2 writing development without the basis on linguistically-interpreted analyses of syntax (Biber et al., 2020). Lei (2017) found that some syntactic complexity measures could not reflect the genre characteristics of written language, or may be negatively correlated with writing quality. Thus, fine-grained measures, such as the frequency of relative clauses, has been utilized more in the investigation of syntactic complexity development. In the study of Ziaieian et al. (2022), twenty-two fine-grained phrasal and clausal indices were employed to investigate syntactic complexity in the discussion section of research articles in three disciplines, revealing significant disciplinary differences in both types of complexity. In addition, some scholars divided these indicators into three categories (unit length, unit density and sentence pattern type) for comparative analysis with native speakers (Lu & Ai, 2015) or for studies on the changes of learners at different levels (Beers & Nagy,

2010; Jiang et al., 2019).

Secondly, as to the relationship between syntactic complexity and second language level, many researchers found that there existed a correlation between these two variables while changes in various syntactic complexity measures were not synchronized, and syntactic complexity manifested itself differently in learners at different levels (Ortega, 2003; Larsen-Freeman, 2006; Ji, 2009; Crossley & McNamara, 2014; Lu & Xu, 2016). Moreover, relevant studies showed that large-grained syntactic complexity measures were effective predictors of language proficiency, and their predictive power were generally higher than fine-grained measures of clausal complexity and fine-grained measures of phrasal complexity (Biber et al., 2020; Gao, 2021).

In addition, research on the development of syntactic complexity mainly starts from two perspectives, namely cross-sectional analysis that across time periods and longitudinal study inside of a column. Cross-sectional studies have indicated that the development of indicators is unbalanced (Ansarifar et al., 2018; Qin & Wen, 2007; Casal et al., 2021), while longitudinal studies have found disparities in the developmental trajectories of different measures for each person (Verspoor et al., 2008; Ji, 2009; Huang et al., 2022). Therefore, to better evaluate learners' syntactic complexity, it is truly necessary to classify them in terms of language proficiency levels and adopt diverse accurate measure indexes.

Last, research on factors influencing second language writing mainly investigate internal factors and external factors (Sotillo, 2000; Way et al., 2000; Ellis & Yuan, 2004; Lu, 2015; Kuiken & Vedder, 2019; Qian et al., 2021; Yoon, 2017; Lowie & Verspoor, 2019; Yoon & Polio, 2017). Internal factors generally refer to complex factors related to learners, such as emotional factors, writing strategies, and writing proficiency in the native language. For instance, Lu (2015) found that different L1 backgrounds have a significant impact on syntactic complexity measures. Lowie and Verspoor (2019) argued that L2 learners didn't form ergodic ensembles and that language learning data lack stability. Additionally, research on the influence of external factors related to writing tasks mainly focus on several aspects, such as task complexity (Asgar & Soghra, 2012; Wang, 2013; Zhang & Jiang, 2020), planning conditions (Foster and Skehan, 1996; Ellis, 2009; Li and Fu, 2016), and task type (Yang et al., 2015; Yoon & Polio, 2017). Despite extensive research efforts, the influence of topic difference on syntactic complexity is still yet to be further explored.

Given this, in order to explore how learners' syntactic complexity develop along with their L2 proficiency and what influence different writing topics have on learners' syntactic complexity, research questions in this study are as follows:

- (1) What are the differences in the syntactic complexity among learners with different L2 proficiency?
- (2) In what way do different writing topics affect syntactic complexity?

3. Research Methodology

3.1 Corpus Collection

The corpus used for the present study was selected from The ICNALE Written Essays V2.4 corpus, a

core module of ICNALE (Ishikawa, 2013). ICNALE, the International Corpus Network of Asian Learners of English, consists of topic-controlled speeches and essays produced by various learners of English and has become one of the largest learner corpora publicly available. Different from ICLE or LINDSEI focusing on European and American English learners, it pays more attention to Asian learners, and has included more than 10000 keynote speeches and compositions written by undergraduate and postgraduate students from a number of Asian countries and regions (Mainland China, Hong Kong of China, Taiwan of China, Indonesia, Japan, South Korea, Pakistan, Philippines, Singapore, Malaysia and Thailand) and some English-speaking countries. The corpus consists of four core modules, namely spoken monologue, spoken dialogue, written essays as well as edited essays. Considering that the present study mainly investigated syntactic complexity in learners' writing, the written essays corpus that was updated and released in December 2020 was chosen for corpus used in this article, containing 5,600 compositions written by 2,600 English learners and 200 native speakers, totaling 1.3 million words. To be specific, the gender ratio of learners involved in this corpus is 43.35/56.65, and the average age and English learning duration are 19.66 years and 11 years respectively. Moreover, their educational background covers many fields such as social sciences, natural sciences, humanities and life sciences, which ensures the high degree of balance and representativeness of the corpus.

Additionally, after converting learners' scores in various international language proficiency tests like TOEIC, TOEFL and IELTS into corresponding CEFR levels, ICNALE adopts CEFR (Common European Framework of Reference for Languages) descriptors of language ability as one of the corpus grading scales. CEFR is a set of recommended standards adopted by the Council of Europe in November 2001, which can be used to assess the achievement of language learners in the language they have learned, and also give educational evaluation guidelines. It describes language learners' ability in terms of speaking, reading, listening and writing at six reference levels from A1, A2, B1, B2, C1, to C2, which has been recognized and highly accepted by governments and educational institutions in various countries. The corresponding relationship between different test scores and CEFR levels is shown in Table 1.

Table 1. The Mapping Relationship between Different Language Proficiency Test Scores and CEFR Levels

CEFR (A1-C2)	IELTS (Note 1) (0-9)	TOEFL iBT (Note 3) (0-120)	TOEFL (Note 3) (311-677)	PBT TOEIC (Note 4) (10-990)
A1	1-2	-	-	-
A2	3	-	-	-
B1	3.5-4.5	57-86	457+	550+

B2	5-6	87-109	-	-
C1	6.5-7	110-120	560+	880+
C2	7.5+	-	-	-

This study randomly selected 1840 English as a second language (ESL) learners with CEFR levels of A2_0, B1_1, B1_2 and B2_0 (hereinafter referred to as A, B, C, D) from The ICNALE Written Essays V2.4 corpus. The two topics they wrote are “It is very important for college students to have a part-time job” (hereinafter referred to as “part-time job” or PTJ) and “All restaurants in the country should completely ban smoking” (hereinafter referred to as “non-smoking” or SMK), each of 920 articles as observation corpus. To ensure comparability between different groups, the corpus consisting of 1840 compositions were divided into 8 sub-corpus in terms of different topics and CEFR levels of L2 learners, as shown in Table 2. Although writing topic may have an impact on the writing output of second language learners, considering that there is no significant difference in the familiarity of college students with the topics of “part-time job” and “non-smoking”, these two topics were selected as observation samples in this study.

Table 2. Detail Description of Sub-Corpora

Sub-corpus	N. of Sample	N. of Words	N. of Tokens
PTJ_A	230	50930	226827
PTJ_B	230	52903	236496
PTJ_C	230	55336	255818
PTJ_D	230	56551	268176
SMK_A	230	50596	234816
SMK_B	230	51448	240516
SMK_C	230	53857	257028
SMK_D	230	53758	261433

After validating the accuracy, clarity, and details of data, it was found that the essays on the topic of “non-smoking” written by participants with identification codes of JPN_123 and JPN_396 are similar. In addition, the essays on the topic of “non-smoking” and “part-time job” written by the participant with identification codes of JPN_093 have duplicated paragraphs. In order to reduce the likelihood of error occurrence as much as possible, the two essays numbered JPN_123 and JPN_093 were replaced by JPN_126 and JPN_098, respectively.

3.2 Research Tools

This study mainly uses Stanford Parser (Note 5) for syntactic analysis, that is, obtaining the required indicator value of syntactic complexity so as to perform further analysis. As an open-source statistical syntactic analyzer developed by the Natural Language Processing Group of Stanford University, Stanford Parser uses the authoritative and reliable English Penn Treebank as its training data. Based on the notion that there exists a direct link between every linguistic unit of a sentence which is termed dependencies, it can be used to analyze the sentence structure and label different components in the sentence, or label that sentence with part of speech specific to a word segmentation unit. Taking sentences written in several languages such as English, German, Arabic and Chinese as input, it gives output relating to typed dependencies between different words in a sentence, which is vividly shown in tagging, parsing and collapsed dependencies. It must be noted that before entering the text to be processed, words shall be segmented in advance, and each word segmentation unit should be separated with a space character. After the processing of this parser, the overall structure of a sentence can be displayed in a tree form, in which the leaf nodes are the word segmentation units. At the same time, it also provides a number of interface functions for displaying the dependencies between word segmentation units within the sentence, describing the relationship between two words in a sentence. Taking “Bell, based in Los Angeles, makes and distributes electronic, computer and building products.” as an example. The result of the dependency analysis is shown in Figure 1 below, where *nsubj* denotes nominal subject and the noun-subject relationship, while *amod* is the adjectival modifier and the adjective-modifier relationship.

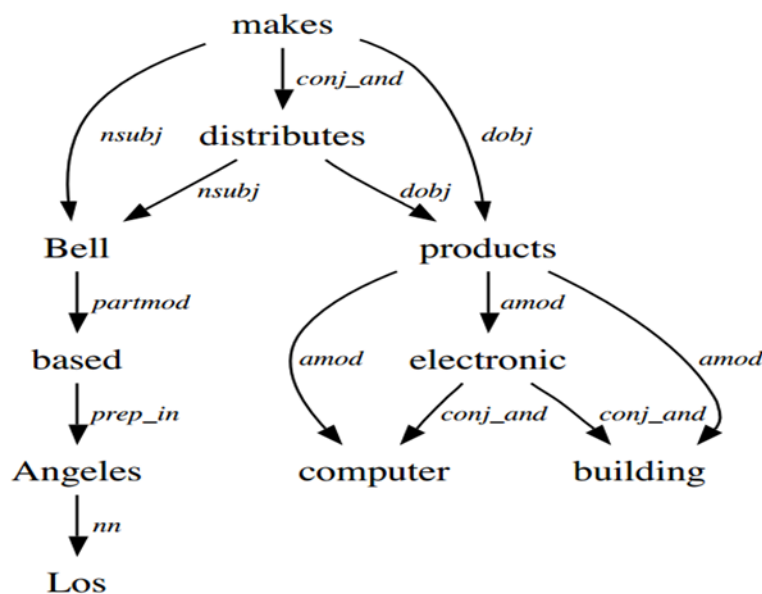


Figure 1. Diagram of Dependencies in a Sentence

Previous experimental results have shown that the Stanford dependency parser outperforms other parsers using sparse indicator features in both accuracy and speed, which is performed by only relying on dense features and automatically learning the most useful feature conjunctions for making predictions (Chen & Manning, 2014). To confirm that the annotation of dependency relations facilitates the extraction of syntactic complexity measures for the current study, two postgraduate students of applied linguistics also completed the parsing and annotation of 100 articles. Cohen's kappa test indicated that the software-annotator agreement score between Stanford dependency parser and the two postgraduates for the parsing was acceptable ($p = .001$), ensuring the accuracy and the reliability of parsing and annotation results produced.

3.3 Statistical Analysis

The 1840 essays selected were imported into Stanford Parser 4.2.0 for dependency analysis, and the analysis results of syntactic complexity indicators like *advcl*, *ccomp*, *acl:recl* in the clause level and *nmod:poss*, *compound*, *amod* concerning noun modifiers required for the present study were obtained, as shown in Table 3. Then a self-compiled python script was run to measure the number of occurrences of each indicator in every single sentence and then convert text files into excel files.

Table 3. Six Syntactic Complexity Indicators Used in the Study

Level	Grammatical Structure	Dependency Relations	Example in the Corpus
Clause	adverbial clause	<i>advcl</i>	It would be useful when I get a job.
	complement clause	<i>ccomp</i>	I agree this statement that it is important for college. Students to have a part time job.
Noun modifiers	relative clause	<i>acl:recl</i>	But I have many friends who smoke.
	possessive modifier	<i>nmod:poss</i>	my reason
	compound	<i>compound</i>	lung cancer
	adjective modifier	<i>amod</i>	a good point

After that, tables of six syntactic complexity indicator values in different sub-corpus were imported into SPSS 26. Firstly, the topic variables were controlled, and descriptive statistics were conducted to analyze the trend of values of six syntactic complexity indicators under the topic “part-time job” and “non-smoking” respectively. Subsequently, taking the topic as an independent variable, a significant difference analysis of the mean value of 6 indicators was carried out to investigate the influence of topic difference on second language writing.

4. Results and Discussion

This section mainly presents and discusses the statistical analysis results of the measured values of six syntactic complexity indicators.

4.1 The Performance on Syntactic Complexity of English Learners at Different Levels

4.1.1 Syntactic Complexity at the Clause Level

Table 4. Syntactic Complexity of Learners at Different Levels at the Clause Level

	<i>advcl</i>		<i>ccomp</i>		<i>acl:recl</i>	
	M	SD	M	SD	M	SD
A	0.35	0.65	0.33	0.65	0.20	0.49
B	0.37	0.63	0.30	0.55	0.19	0.46
C	0.42	0.68	0.32	0.57	0.24	0.50
D	0.47	0.69	0.33	0.57	0.22	0.48

As can be seen from Table 4, for English learners at all levels, the relative clauses represented by *acl:recl* are the least frequently used among three types of clauses. In other words, learners at different levels are generally more inclined to use adverbial clauses (*advcl*) and complement clauses (*ccomp*) than to use relational clauses to modify and limit antecedents, which is consistent with the relevant research results of many previous scholars (Jiang et al., 2019). Learners deliberately avoid the use of relational clauses in English essays writing, which is mainly due to the differences in language structure between English and learners' mother tongue, and language transfer has a negative impact on second language writing. For example, although both Chinese and English have the representation of mutual relationship, the concept of "relative pronoun" does not exist in Chinese grammar. Mutual relationship in Chinese is commonly expressed by the character "的", which is usually placed before the central noun; while in English, there are not only various relational pronouns such as *who*, *which*, *that*, but also relational adverbs such as *when*, *where* and *why*, which are often used after the central noun. This similarity and difference in language structure makes it easier for East Asian learners including native Chinese to confuse the form and application of relational clauses in the two languages. They are more likely to lose points due to the negative transfer of their mother tongue, which leads to learners' intentional underuse or even avoidance of use of relational clauses. At the same time, this study also shows different results from Jiang's (2014). With the second language proficiency from low to high, learners' use of relational clauses does not show the development and changes of "low output, excessive output and flexible application". Instead, it is more similar to the three dynamic development stages of excessive output, low output and flexible application. This is probably related to the different classification criteria of second language proficiency selected by the two studies. Jiang's study only takes "didn't pass CET-4 group", "passed CET-4 but didn't pass CET-6 group" and "passed CET-6

group” (CET here referring to China’s College English Test Band) as the research object, and does not make a finer division of the high-level learners.

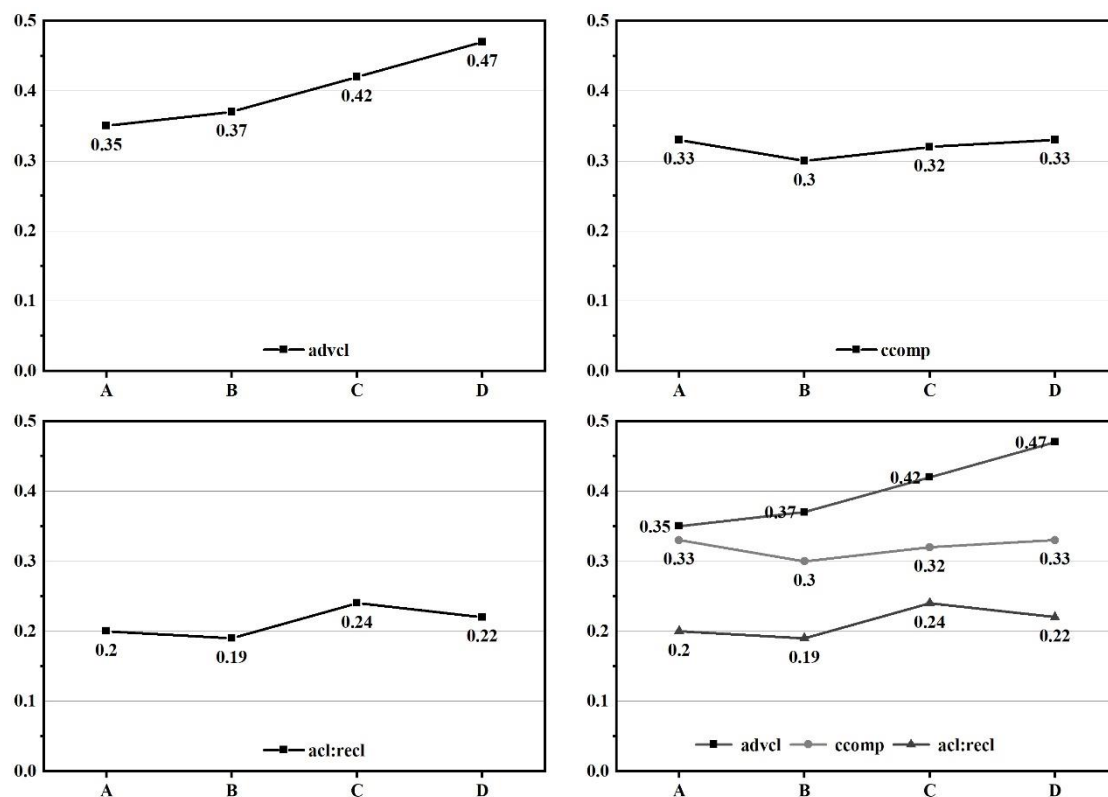


Figure 2. Development Trends of Three Syntactic Complexity Indicators at the Clause Level

At the same time, combined with figure 2, it can be found that with the gradual improvement of learners’ second language level from A to D, the frequency of adverbial clauses continues to rise and it climbs to the peak when learners reach level D. In addition, the frequency of both relational clauses and complement clauses show a downward trend from level A to B, but then complement clauses continues to increase while relational clauses having a tendency of falling after a transient rise. These turning points jointly support the research conclusions of Ji’s (2009), which is the development of syntactic complexity of second language learners presents a nonlinear trend. In other words, with the increase of learners’ vocabulary and grammar knowledge, their second language level has gradually improved. Accordingly, various indicator values of syntactic complexity in second language writing show different development trends, having confirmed the validity of complex dynamic systems theory in language learning. Admittedly, as shown in the frequency of relational clauses from level B to D, second language learners at a certain level have basically learned a certain type of clause form but they have insufficient grasp of this, thus the linguistic phenomenon “fossilization” of sentence pattern will appear. As claimed by the dynamic system theory, fossilization is a state in which the language system stays in the suction state and cannot be surpassed. This requires that in the teaching of second language

writing, it is necessary to solve learners' difficulties at different levels in sentence patterns and strengthen their internalized grasp of different patterns.

4.1.2 Syntactic Complexity Related to Noun Modifiers

Table 5. Syntactic Complexity Related to Noun Modifiers of Learners at Different Levels

	<i>nmod: poss</i>		<i>compound</i>		<i>amod</i>	
	M	SD	M	SD	M	SD
A	0.24	0.55	0.49	0.95	0.75	0.97
B	0.34	0.63	0.46	0.85	0.81	0.96
C	0.38	0.67	0.59	1.00	0.97	1.07
D	0.36	0.63	0.57	0.89	1.09	1.13

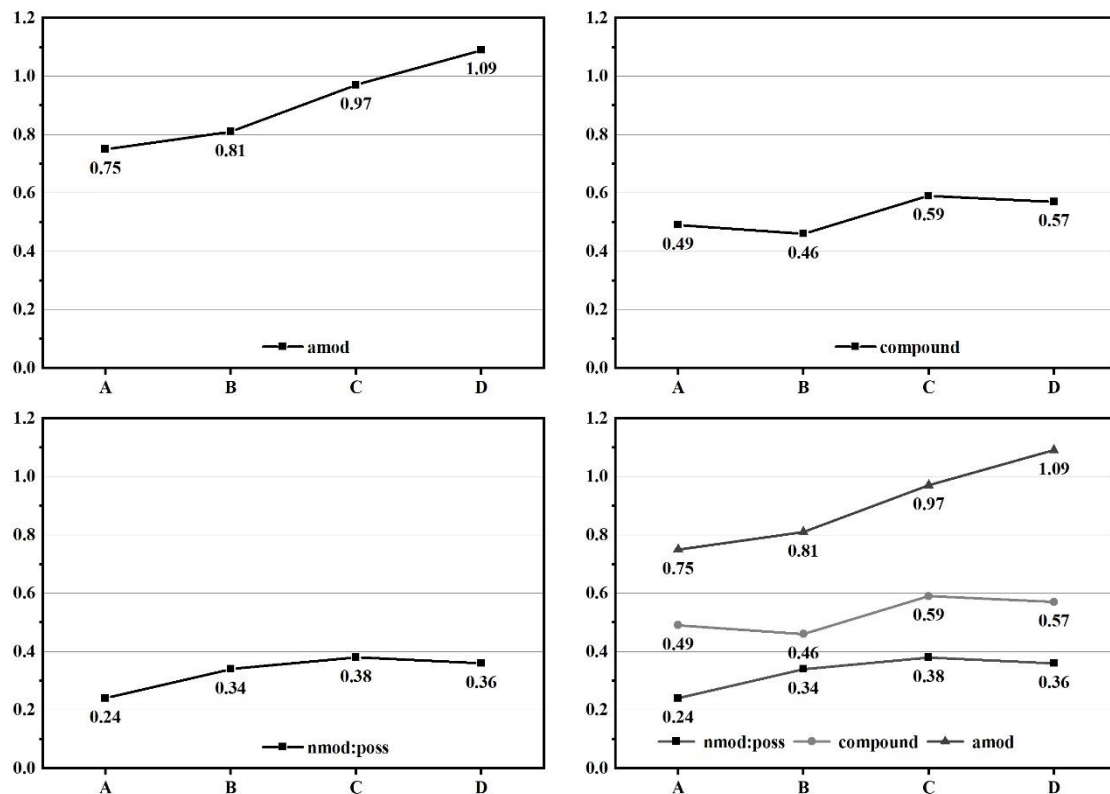


Figure 3. Development Trends of Three Syntactic Complexity Indicators Related to Noun Modifiers

It can be seen from table 5 and figure 3 that among the three noun modifiers including possessive modifier (*nmod: poss*), *compound* and adjective modifier (*amod*), English learners at all levels use adjective modifiers most and possessive modifiers the least often in essays writing. In addition, with the gradual improvement of learners' English proficiency levels, only the frequency of adjective

modifiers shows a constantly increasing trend. Both possessive modifiers and compound nouns showed an irregular trend of sometimes rising and sometimes falling, which has a certain relationship with learners' under-use of possessive at a lower level. That is to say, adjective modifiers are the best indicator in distinguishing English learners' level and can be used as an important reference for evaluating second language proficiency. Compared with the A-level learners, D-level learners increased the use of all three types of noun modifiers. This finding partially supports the conclusion of Crossley & McNamara (2014) that the high-scoring composition contains more noun-phrase modifiers, but the decline in their use by intermediate-level learners should also be noted.

4.2 The influence of Different Topics on Syntactic Complexity

Table 6. Syntactic Complexity under the Topic “Part-time Job”

	<i>advcl</i>		<i>ccomp</i>		<i>acl:recl</i>		<i>nmod:poss</i>		<i>compound</i>		<i>amod</i>	
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
A	0.42	0.600	0.31	0.524	0.16	0.394	0.18	0.460	0.91	1.128	0.52	0.892
B	0.48	0.681	0.28	0.507	0.13	0.357	0.24	0.495	0.93	1.171	0.48	0.711
C	0.49	0.689	0.36	0.524	0.09	0.303	0.27	0.539	1.05	1.197	0.54	0.781
D	0.52	0.755	0.33	0.508	0.11	0.339	0.37	0.652	1.00	1.219	0.57	0.742

Table 7. Syntactic Complexity under the Topic of “Non-smoking”

	<i>advcl</i>		<i>ccomp</i>		<i>acl:recl</i>		<i>nmod:poss</i>		<i>compound</i>		<i>amod</i>	
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
A	0.31	0.540	0.28	0.496	0.25	0.573	0.13	0.380	0.33	0.724	0.49	0.781
B	0.31	0.537	0.33	0.526	0.15	0.436	0.12	0.361	0.31	0.677	0.34	0.607
C	0.31	0.556	0.31	0.500	0.17	0.433	0.18	0.456	0.29	0.641	0.48	0.680
D	0.39	0.669	0.27	0.489	0.22	0.461	0.18	0.428	0.39	0.814	0.55	0.771

The 1840 essays under the two topics “part-time job” and “non-smoking” are divided into four groups according to the level of learners' second language, and six indexes of syntactic complexity are measured and analyzed by descriptive statistics. The results are shown in Table 6 and Table 7 respectively. It can be observed that although the two topics have no significant difference in the *ccomp* index, they all show significant differences in the other five syntactic complexity indicators. The values of *advcl* ($p=0.003$), *nmod:poss* ($p=0.032$), *compound* ($p=0.001$) and *amod* ($p=0.105$) in the “part-time” topic writing of learners of different levels are higher than those of the same level of writing

“non-smoking” composition, while the measured value of *acl:recl* ($p=0.030$) in “non-smoking” essays is slightly higher. That is, learners tended to use more adverbial clauses, possessive modifiers, compound noun and adjective modifiers, and fewer relative clauses when writing on the topic of “part-time job” compared to “non-smoking”. However, only adverbial clauses and compound nouns showed significant differences in the frequency of use between the two topics. This finding partially supports the conclusion of Yoon et al. (2017) that it is the task type rather than the task that affects language complexity. On the other side, this study also confirms certain effect of task complexity on syntactic complexity. In other words, although topics belonging to the same task type like argumentative essays or expository essays are different, they have no significant impact on learners’ syntactic complexity.

The reason for part of the difference is that the more relevant the writing topic is to the learners themselves, the higher the syntactic complexity (Yoon, 2017). Since the creators of the ICNALE composition corpus selected by the research are basically students who are college students or above, compared with public issue topics such as “non-smoking”, “part-time job” is closer to their real life or past experience, which makes it easier to produce compositions with overall high syntactic complexity. This is consistent with Yoon’s (2017) findings that students tend to produce more complex sentences when they are asked to write on a topic that is more familiar and of interest to them. In addition, the intentional use of relative clauses also reflects that when learners are writing on topics about public issues, they may consciously use sentences that are rarely used and confront with difficulty to increase their syntactic complexity and achieve better grades.

It is also worth noting that even for those EFL with the same L2 proficiency level, they may substantially differ in writing style under different topic because the L2 development process is highly individual (Lowie & Verspoor, 2019) and dynamic (Verspoor et al., 2008) in nature. Put differently, as students have mastered different cognitive resources and strategies in various learning experiences, they may select diverse way to write which can be reflected by syntactic complexity. Thus, paying special attention to individual differences and dynamic development embedded in syntactic complexity contributes to the improvement of L2 writing proficiency and acquisition.

5. Conclusion

The research shows that: (1) The syntactic complexity of L2 learners of different levels develops non-linearly. With the improvement of learners’ second language proficiency, the indexes of syntactic complexity at the clause and phrase levels mostly show changes that increase or decrease. Therefore, teachers should carefully observe the learning difficulties of learners of different levels, such as the fossilization that English learners of B and C levels may encounter in relative clauses, and guide students to conduct targeted and in-depth exercises. In addition, this also supports Gao’s (2021) research conclusion that traditional clause complexity indicators are not effective predictors of L2 writing quality. (2) For the syntactic complexity of different topics that belong to the same task type as

argumentative essay, only two indicators of adverbial clauses and compounds showed significant differences, and the other four items showed no significant differences. This shows that when learners write on different topics, there is no significant difference in syntactic complexity, which further extends the academic research on the impact of topics on syntactic complexity.

At present, most research on syntactic complexity still focus on macro-indices, and there is still insufficient research on micro-indices at the level of subordinate clauses and phrases. This research innovatively combines dependency syntax theory and dynamic systems theory into micro-syntax complexity indicators, which is a useful supplement to previous studies focusing on macro-indices, and promotes in-depth research on the syntactic complexity of Asian English learners. In practice, English teachers can adjust the teaching focus according to the students' level in the actual writing teaching, for example, paying special attention to the learning of relative clauses for middle-level and high-level learners, so as to improve their second language writing level.

Admittedly, this study still has certain limitations. The samples in each group are small and it is a cross-sectional study. Future research could expand the sample and conduct horizontal and vertical studies of composition on a variety of topics. In addition, since the corpus selected in this study are all time-limited compositions, there are few opportunities for students to revise and re-edit, which may not fully reflect the real writing level of learners. In the future research, non-time-limited composition corpus can be added to compare with time-limited composition to further investigate the syntactic complexity of composition for learners at different levels.

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Notes

Note 1. Relating IELTS scores to the Council of Europe's Common European Framework.: <http://www.britishcouncil.org/ielts-coeflier.pdf>

Note 2. Mapping TOEFL iBT on the Common European Framework of Reference (2007).

http://www.nocheating.org/Media/Research/pdf/CEF_Mapping_Study_Interim_Report.pdf

Note 3. TOEFL iBT Scores: Better information about the ability to communicate in an academic setting (2005). <http://www.oia.usc.edu.tw/download/files/TOEFL%20IBT%20Scores.pdf>

Note 4. Tannenbaum, Richard and Caroline E. Wylie (2005). Research Reports: Mapping English Language Proficiency Test Scores onto the Common European Framework. Educational Testing Services. <http://www.ets.org/Media/Research/pdf/RR-05-18.pdf>

Note 5. <https://nlp.stanford.edu/software/lex-parser.shtml>