



The Longitudinal Study on the Syntactic Complexity of High School Students' English Writing Based on Dynamic Systems Theory

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Abstract. Second language writing is an extremely controversial field of study. This study aims to observe the development and changes of the syntactic complexity of academic writing from 3 selected students at the same level in No.1 High Middle School over four semesters. The research is grounded in dynamic systems theory (DST), which provides a framework for understanding the dynamic and non-linear nature of language development. The L2 Syntactic Complexity Analyzer (L2SCA) was employed and the research examined the overall development trend of syntactic complexity in English writing for the 3 selected students over the four semesters and identifies the similarities and differences in the dynamic features of syntactic complexity among them. The results showed that students reached their peak at the end (the fourth writing), and the trough was at the second writing. At the level of individual learners, it can be found through comparative analysis of 3 students' performances in different dimensions of syntactic complexity that although they were in similar learning environments and completed the same learning tasks, the development of syntactic complexity varied.

Keywords: L2 writing, L2 Syntactic Complexity Analyzer (L2SCA), Dynamic systems theory (DST), Syntactic complexity

1 INTRODUCTION

The L2 writing performance in the field of second language acquisition(SLA) has drawn great scholar's attention (Lu, 2020)^[15]. The previous studies have shown Error Analysis(EA) theory helps to identify types and causes of academic writing errors made by learners and improve their English language competences like the study of ^[5]Kam-pookaew (2020). ^[2]Corder (1981) pointed out that errors offer language system's evidence that a learner is using, even if it's not the correct system and contribute to teachers and researchers in analyzing the incorrect system that the learner is using and providing chances to correct errors. These past studies seem to emphasize the reasons for these learning results rather than the process of L2 acquisition. Until ^[8]Larsen-Freeman (1997) came up with that, the dynamic systems theory(DST) weakened the single

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causal theory and began to explore the learning development process, as well as the differences within individuals emerging in the development of second language development (SLD).

Developmental indexes are constructed to establish and report writing levels of L2 learners instead of vague assessments like ‘good’ or ‘intermediate’ (Hu, 2017)^[4]. Existing studies generally focus on complexity, accuracy and fluency (CAF) as measurement standards for evaluating L2 writing ability (Li, 2017^[10]; Wang, 2020^[14]). While few studies have focused on differences in individual language development by more detailed syntactic complexity indicators from a dynamic perspective, especially for these Chinese students who are about to take the college entrance examination in China and are facing syntactic problems in English writing (Lu, 2020)^[15]. Overall, DST will be used as a theoretical framework to examine English writing development of Chinese EFL learners, with important implications for future studies related to teachers’ writing teaching strategy. This study conducted a four-semester tracking survey of three second-year high school students, in order to find the developmental features of written English from four indicators of syntactic complexity, and answered the following research questions:

1. What is the overall development trend of syntactic complexity in English writing for 3 selected students at the same level over the four semesters?
2. What are the similarities and differences with regards to dynamic features for 3 selected students’ syntactic complexity?

2 LITERATURE REVIEW

2.1 Theoretical Framework: Dynamic Systems Theory

Language learning and language development can be studied theoretically using the DST. The dynamics of language learning can be explained in two aspects: (1) Language learning is not simply the acquisition of fixed language forms and rules, but the constant adjustment of one’s own language resources in order to adapt to new situations. (2) The catastrophic changes are caused by small changes in language use in everyday life. A longitudinal case study is a common way to study variability in DST research (Guo & Chen, 2020)^[3]. ^[9]Larsen-Freeman (2007) showed that most of the research belongs to cross-sectional, and few longitudinal methods were applied during the development of a second language over time. ^[6]Xu(2023) has stated that the main reason, perhaps, is that participants had difficulty focusing on one or more experiments for long periods of time. In view of this, further empirical research is necessary to fill the gap in this area.

2.2 Syntactic Complexity Hypothesis

Syntactic complexity has attracted much attention from researchers within the field of linguistic complexity, and during the testing of L2 writers’ levels of linguistic performance, development and global proficiency, syntactic complexity is one of the most commonly used constructs. There have been many previous studies on syntactic complexity to help teachers evaluate and improve students’ English writing levels. (see, for

example, Lei et al., 2023)^[13]. While these studies tend to be cross-sectional, more longitudinal dimension research should be carried out to examine whether various syntactic complexity indicators are more credible when used to test students' writing quality. Looking at the syntactic complexity index, the current small number of longitudinal studies shows that the development trends of students' writing are generally similar and there are individual differences to some extent, which are caused by the writers' English proficiency level, L1 background, and task type(Li, 2017)^[10]. Therefore, here's a hypothetical, what is the change in the individual's syntactic complexity developed from the longitudinal aspects if participants have the same L1 background and language proficiency even if they are designed for the same writing task type? This study conducts a four-semester tracking survey of three second-year high school students, in order to find the developmental features of written English from four indicators of syntactic complexity.

3 METHODOLOGY

3.1 Participants

Three students in Grade 2 at the No.1 middle school in Puyang county, Henan province, are purposely selected with the same English scores on the English examination, but their English test scores are not very high, participants involved 2 female students and 1 male student, and pseudonyms were used to protect their privacy.

3.2 Data Collection and Analysis

They are required to write about the same topics four times during the two years. We collected 12 written texts from students, totaling four times over four semesters.

The collected data was analyzed by the L2 syntactic complexity analyzer (L2SCA) developed by Xiaofei's team to explore the 4 index of syntactic complexity, and then used SPSS 28.0 software to organize and analyze the data. Through Excel 2007, the trajectories of various learners' syntax complexity indexes were plotted separately.

4 RESULT

4.1 General Trend of Syntactic Complexity

The four indexes from sentential, clausal, and phrasal dimensions for every individual were analyzed by L2SCA and the results were collected(appendix in another folder). Then, the mean value and standard deviation of the group in every essay were calculated by using SPSS (28.0) to analyze the overall development trend of syntactic complexity in English writing for three selected students at the same level over the four semesters (Bi&Jiang, 2020)^[1].

Table 1. Descriptive Statistics of Syntactic Complexity

student	MLT		C/S		DC/C		CP/C	
	Mean	Std.D	Mean	Std.D	Mean	Std.D	Mean	Std.D
a	19.695	3.367	2.98	0.238	0.51	0.032	0.088	0.068
b	19.695	3.367	2.98	0.238	0.51	0.032	0.088	0.068
C	16.195	4.906	2.625	0.947	0.51	0.181	0.063	0.01

As is shown in Table.1, among the four writings, although there is some decline in every index in the second writing, the participants have made progress in the MLT, C/S, and DC/C. The value of the mean length T-unit (MLT) increases by 10.057 words, the ratio of clauses per sentence (C/S) increases by 1.05, and the ratio of dependent clauses per clause (DC/C) increases by 0.133. However, the ratio of coordinate phrases per clause (CP/C) doesn't change (Hu, 2023)^[12].

4.2 Individual Trends of Syntactic Complexity

In this part, we used SPSS (28.0) and Excel to examine the individual trends of syntactic complexity during the four semesters of English writing (Kuiken, F. et al., 2019)^[7]. We plot the normalized data of the four syntactic complexity measures on one graph. By comparing different states of the trajectories at one certain data point, we can observe the intra-individual variability that emerges in the time-serial data. In the following three figures, the solid lines represent the observed mean values of MLT, C/S, DC/C, and CP/C, and the broken lines represent the trend lines (Larsen-Freeman, 2023)^[9].



Fig. 1. Student-a's Trajectories of Syntactic Complexity

Figure 1 shows that student-a ends with a little higher value than the initial one for MLT and C/S, but with a lower value for DC/C and CP/C. What’s more, the final values of four indexes are so close to the initial value, which means that the final value may be a stable state for student-a. What’s more, the development of four indexes differs; for example, the DC/C ratio dips to the lowest at the fourth writing while MLT reaches a peak, and the lowest CP /C ratio at the third writing, and C/S reaches a peak at the third writing. All in all, the student-a’s syntactic complexity is stable.

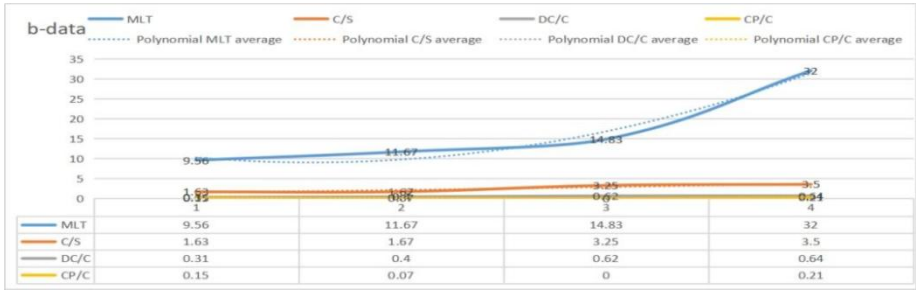


Fig. 2. Student-b’s Trajectories of Syntactic Complexity

Figure 2 shows that student-b ends with a much higher value than the initial one for MLT, and a little higher value for C/S, DC/C, and CP/C, so the final value of four indexes increased, which means that student-b has made progress. However, there is a prominent CP/C ratio that dips to the lowest at the third writing. Which means student-b didn’t use the ratio of coordinate phrases in the third writing.

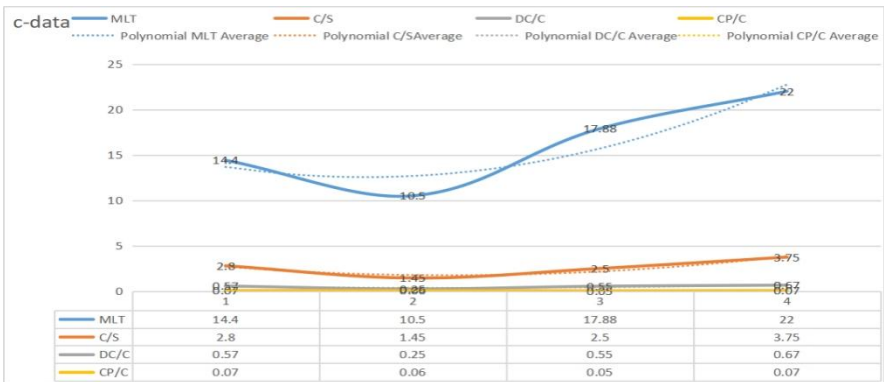


Fig. 3. student-c’s Trajectories of Syntactic Complexity

Figure 3 shows that student-c ends with a higher value than the initial one for MLT, C/S, and DC/C but with the same value for CP/C. The development of four indexed differs. For example, The length of MLT and C/S DC/C ratio dip to the lowest at the second writing and the lowest of CP/C ratio at the third writing, while they all reach peaks at the end, indicating that the student-c’s syntactic complexity has a minimal increase.

4.3 Comparison of the syntactic complexity of different individuals

We used SPSS (28.0) to make a horizontal comparison of the mean values and standard deviations of the three students, because the trend of the average value can leave an intuitive overall impression (Martínez, 2024)^[11].

Table 2. Previous Mean and Standard Deviation of Syntactic Complexity Index

student	MLT		C/S		DC/C		CP/C	
	Mean	Std.D	Mean	Std.D	Mean	Std.D	Mean	Std.D
a	19.695	3.367	2.98	0.238	0.51	0.032	0.088	0.068
b	19.695	3.367	2.98	0.238	0.51	0.032	0.088	0.068
c	16.195	4.906	2.625	0.947	0.51	0.181	0.063	0.01

In terms of Table 2, the length of language output, the MLT values are 19.695, 19.695, and 16.195. We can see that student-a performed poorly, and there is no difference in the performances of a and b. In terms of subordinate structure, the DC/C values of the students are the same, showing that there is no difference. In terms of sentence complexity, the C/S values are 2.98, 2.98, and 2.625. All three students performed very close to each other. In terms of coordinate structure, the CP/C values are 0.068, 0.068, 0.01. The low values indicate that students didn't have a good command of the use of coordinate clauses, especially student-c.

5 CONCLUSION

According to DST, students showed different trajectories of development, full of progress and regression, stagnation and jumps. The syntactic complexity of students is generally fluctuating upward. From the above data analysis results, it can be known that students reached their peak at the end (the fourth writing), and the trough was at the second writing, maybe because they took online classes, and most students had poor study status during that period. The study also found that MLT was higher than the initial values and had the largest floats, indicating that the length of their language output increased. Other indexes showed there were no obvious development trends in general. At the level of individual learners, it can be found through comparative analysis of 3 students' performances in different dimensions of syntactic complexity that although they were in similar learning environments and completed the same learning tasks, the development of syntactic complexity varied.

Teachers can develop more targeted classroom activities according to current trends in syntactic complexity. As exposure to English syntax increases, teachers can also consciously train students to vary their expressions, for example, by using different

syntactic structures, which helps to avoid homogeneity or overuse of a particular structure. Teachers can guide students to experiment with more complex syntactic structures, such as coordinate clauses and subordinate clauses, to further enhance the syntactic appropriateness and variety of their writing.

The current research sample is relatively small and only targets high school students in a less developed area of China. Future research can expand the sample and expand the participation of students in more developed areas of China and even international schools.

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