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Retraction

Retracted: Analysis of Syntactic Complexity and Semantic Coherence of Academic English Writing Based on Particle Swarm Optimization

Mobile Information Systems

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This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope
(2) Discrepancies in the description of the research reported
(3) Discrepancies between the availability of data and the research described
(4) Inappropriate citations
(5) Incoherent, meaningless and/or irrelevant content included in the article
(6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

References

[1] L. Li, "Analysis of Syntactic Complexity and Semantic Coherence of Academic English Writing Based on Particle Swarm Optimization," *Mobile Information Systems*, vol. 2022, Article ID 9917832, 9 pages, 2022.

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Research Article

Analysis of Syntactic Complexity and Semantic Coherence of Academic English Writing Based on Particle Swarm Optimization

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Writing is an important part of testing language ability, and it is urgent to find some objective indicators to determine and evaluate the surface language structure, which will help language learners' better master the target language. Complexity and semantic coherence are considered to be an important factor in the teaching of second language writing. In practice, due to the complexity of English writing syntax, such as a large number of high-dimensional nonlinear optimization problems, a new intelligent evaluation method is needed to solve them. At present, particle swarm optimization (PSO) has been widely used in function optimization, neural network training, combinatorial optimization, and other fields. This paper studies the syntactic complexity and semantic coherence of academic English writing based on PSO. The number of phrases is related to writing achievement. When the number of experiments reaches 25, the significant values of syntactic complexity and semantic coherence of data mining algorithm, artificial intelligence algorithm, decision tree algorithm, and PSO algorithm are 0.008, 0.003, 0.002, and 0.013, respectively, which shows that PSO algorithm is the best among them.

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1. Introduction

English writing is not only an important part of English teaching but also one of the difficulties of English teaching. There are still syntactic problems in Chinese students' English writing. In recent years, while analyzing the writing performance of language learners, Chinese researchers have completed a series of studies on second language writing. They found that even senior Chinese students show language ability. The characteristics related to oral discourse and the complexity and semantic coherence of simple sentences in their works have made a comparative study on the language characteristics of English writing in Chinese universities and American College Students [1, 2]. Complexity refers to the combination degree of language use, which usually reflects the length of discourse and the subordinate level of use. Syntactic complexity, also known as syntactic maturity or language complexity, refers to the scope of language output forms and the degree of formal complexity. When describing syntactic complexity, the length of output units, the embedding amount of clauses, the scope of structural types, and the complexity of special structures are quantitative objectives. Writing is an important part of testing language ability. It is urgent to find some objective indicators to determine and evaluate the surface language structure, which will help language learners become more proficient in the target language [3]. Syntactic complexity and semantic coherence are considered to be an important factor in second language writing teaching. There is also research that complex noun phrases can help us use refined phrases to express ideas [4, 5]. Encourage students to simplify subordinate sentences, simple sentences, and compound sentences into phrases. We should consciously use attributives, appositive clauses, and adjective phrases because these languages belong to "noun phrase components", which can increase the noun information density, t unit, and clause length. In addition to t unit and clause length, the index of subordinate clause usage is still one of the keys to improve the quality of composition. Chinese students often use simple sentences, compound sentences, and a small number of object or adverbial clauses in English writing. In writing teaching, we can strengthen the awareness of syntactic complexity through sentence pattern transformation, help them establish the syntactic system of English complex sentence patterns, and master the flexible and appropriate use of various sentence patterns [6, 7].

In practical application, due to the complexity of English writing syntax, for example, there are a large number of high-dimensional nonlinear optimization problems, which need to be solved by a new intelligent evaluation method. At present, PSO algorithm has been widely used in function optimization, neural network training, combinatorial optimization, and other fields. This paper attempts to apply PSO algorithm to the study of syntactic complexity and semantic coherence of English writing. PSO algorithm forms a temporary clonal population through the individual extremum of each particle and generates a new population after clonal amplification; Cauchy mutation is carried out on individuals in the population to increase the diversity of the population, so as to improve the global search ability of the algorithm [8]. The birds in the swarm are abstracted into "particles" without mass and volume. Through the mutual cooperation and information sharing of these "particles", their motion speed is affected by the historical motion state information of themselves and the swarm. The current motion direction and speed of the particles are affected by the historical optimal position of themselves and the swarm, which can better coordinate the relationship between the "particles" themselves and the swarm motion. Find the optimal solution in the complex solution space [9]. When selecting the quantitative index of the population, it should reflect the evolutionary characteristics of the population as much as possible, and the time series in the evolutionary process should have a certain law or pattern. Because the growth of learners' syntactic ability is an integral part of their language ability, her development in the target language is not only used as an oral and written evaluation of language learners and an indicator of learners' proficiency, which is the basis of their performance, but also used to measure the progress of language. Learning some syntactic complexity is reflected in the changes in syntactic changes, complexity, and semantic coherence in second language writing or speaking, or syntactic scope.

The PSO algorithm initializes the population of syntactic complexity and semantic coherence of English writing by using the idea of label propagation and then uses the comparative mutation strategy to update the speed V according to the state quantity of population extreme value and individual extreme value. Then, according to the value of V, the local iterative search method is used to update the particles in the complexity and semantic coherence population. Finally, the single path crossover operation is used to cross the individual in the population with the individual extreme value [10]. One of the reasons for the decrease of syntactic complexity research is that there is no direct relationship between syntactic complexity and writing quality because there are good and poor short sentences and good and poor long sentences, and the relationship between syntactic complexity and writing quality is also affected by the subject matter. Traditional teaching methods focus on language form and try to control and minimize the possibility of grammatical errors without paying enough attention to language. Grammatical complexity gradually causes educators and teachers and many language output evaluation schemes to begin to emphasize the requirements of complexity and change [11]. According to syntactic complexity and semantic coherence, it should help the researchers constantly observe and provide a theoretical framework for interpretation; it should lay the foundation for replication and accumulation of experience and understanding of important structures. Carry out a study on the syntactic complexity of writing materials, and the method of measuring syntax should cover syntactic complexity and diversity. Therefore, unit length, clause density, and sentence type are considered as indicators of syntactic complexity. All particles are in English writing syntax. Both have an adaptation value of writing syntactic complexity and semantic coherence determined by the objective function and know the best position and current position they have found so far. This can be seen as the particle's own flight experience. In addition, each particle in the PSO algorithm also knows the best position of all particles found in the whole group of writing syntactic complexity and semantic coherence, which can be regarded as the peer experience of particles.

In this paper, I mainly put forward the following innovations.

(1) The particle coding method is proposed in this paper. First, each particle in the network is set into a different community, and then iteration is carried out. For each particle, the community to which all its neighbors belong is recorded, and the number of communities to which it belongs is calculated, so that the node becomes the community with the largest number of neighbors. As the community of this node and after this cycle for several times, the division of complex network has greater modularity. Experiments show that this initialization method can initialize the population well.

(2) In the experimental part, the accuracy of PSO algorithm is compared with the other three algorithms. With the increase of the number of experiments, the accuracy decreases, and the accuracy of other data mining algorithms, artificial intelligence algorithms and decision tree algorithms is all reduced to lower values. However, PSO can always divide the syntactic complexity and semantic coherence of academic English writing well. Even when the number of experiments increases, when the number of experiments reaches 50, the PSO can still reach 48%, which shows that PSO has good clustering accuracy.

Chapter one introduces the background and significance of syntactic complexity and semantic coherence in English writing and then introduces the main work of this paper. The second chapter mainly introduces the literature review of syntactic complexity and semantic coherence in English writing. Chapter three describes the syntactic complexity and semantic coherence of PSO. In the fourth chapter, the

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experiment is carried out, and the results are analyzed and discussed. The fifth chapter is a summary of the full text.

2. Related Work

2.1. Research Status. Jothi et al. studied the relationship between oral and written register characteristics and second language writing quality, and found that oral and written register characteristics are related to writing quality in many aspects [12]. Zhang et al. proposed that syntactic complexity follows the development sequence of multiple nested structures from restrictive clauses in the primary stage, unrestricted clauses and nested phrases in the intermediate stage, and to noun modifier clauses and multiple prepositional phrases as post modifiers in the advanced stage [13]. Jeon et al. pointed out that there is a problem of monotonous sentence patterns in students' compositions, and most of them are short sentences, while long sentences that conform to grammar are rare [14]. Chauhan et al. proposed that syntactic complexity indicators can be labeled manually or automatically, but manual labeling has two major defects. First, it is time consuming and laborious, and it is impossible to label large corpora. Second, subjective factors have great influence and are easy to make mistakes [15]. Frear et al. put forward the hypothesis that the higher the complexity of noun structure is not equal to the higher the quality of writing and verified this hypothesis by analyzing the use of interlanguage phrases in learners' and native speakers' doctoral theses [16]. Biber et al. put forward an empirical analysis of the problems existing in the English writing of junior college students from the perspective of syntactic characteristics. It is found that simple sentences are most used in the composition of high-level groups and low-level groups, complex sentences are not used much, and the sentence expression is relatively simple, while the sentence expression of low-level writers is more simple and poor, with little change in sentence patterns and single expression forms. It is an important factor affecting the quality of writing [17]. Joo et al. pointed out that most syntactic complexity indicators, especially language length and juxtaposition dimension indicators, can clearly distinguish syntactic complexity at different language levels. However, there are two problems worthy of attention. First, the scope of some indicators is too general. For example, the measurement of clause structure does not subdivide the specific indicators of spoken and written language. Second, the greater the value of some syntactic complexity indicators, the worse the writing quality may be predicted [18]. Andersen et al. proposed that the composition contribution generally found that the syntactic complexity in writing increases with the extension of learning time and the improvement of language level, but there is no final conclusion on the measurement dimensions and methods of syntactic complexity corresponding to specific language level, and whether the stronger syntactic complexity is equivalent to the higher writing quality or language level [6]. Leikin et al. proposed the change of syntactic complexity of English learners' compositions and found that the length index increased the fastest in grades 1-2 and then decreased first and then increased, but the increase and decrease range was small. The density index reaches the peak in grade 2, but the range of change before and after is very small, and there is no obvious development trend [19]. Knudson proposed that the change of syntactic complexity over a period of time is in contrast to the differences in other aspects. Among different proficiency groups, most of them are interested in finding syntactic structure and are sensitive to different proficiency levels [20].

2.2. The Research Status of This Method. Based on PSO, this paper studies the syntactic complexity and semantic coherence of academic English writing, is interested in using the syntactic complexity of academic English writing as an index, and evaluates the impact of teaching intervention on grammar and writing ability, such as teaching plan, writing task, writing plan, task type and type, and so on. Under the PSO algorithm, syntactic complexity is defined as "the ability to compress more and more ideas or information blocks into less content ". "Later studies have shown that this definition is incomplete because it involves only a large amount of information. Therefore, they incorporate changes in sentence types into the definition of syntactic complexity. Teachers can clearly understand students' progress and evaluate them based on PSO algorithm. After a period of teaching, students' changes in syntactic complexity can be invented. Based on these findings, they can adjust and improve the syllabus and design the most effective teaching methods Good teaching design to improve students' writing ability and language proficiency. In the teaching of academic English writing based on PSO algorithm, students should be provided with enough writing training opportunities to strengthen the syntactic complexity of learners' writing. Second, we should emphasize which subordinate structures have the characteristics of written language, such as subordinate connectives, relative clauses, nonrestrictive adverbial clauses and so on. Finally, use specific language examples to remind students not to abuse compound noun structure.

3. English Syntactic Complexity and Semantic Coherence of PSO

3.1. Particle Swarm Optimization and Its Principle. Once PSO was proposed, it immediately attracted extensive attention of scholars in the fields of evolutionary computing, computer science and management science, and achieved a large number of research results. At present, PSO is an effective optimization tool for nonlinear continuous optimization problems, combinatorial problems, and mixed integer nonlinear optimization problems [21]. PSO algorithm has the advantages of fast search speed, high efficiency, and simple algorithm, but it is also easy to fall into local optimization and premature phenomenon. Therefore, the combination of other intelligent optimization algorithms and PSO algorithm to make the two algorithms complement each other, so as to avoid the PSO algorithm falling into local optimization is the research hotspot of the majority of scholars. Different from the genetic algorithm based on

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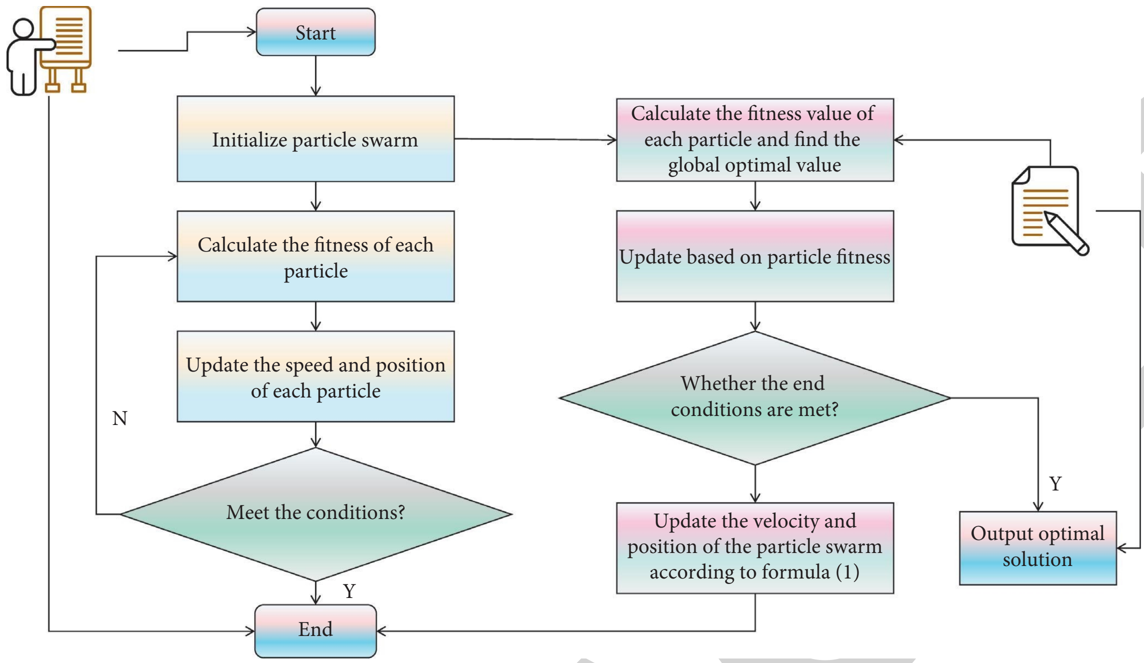

Figure 1: Flow chart of PSO algorithm.

Darwin's evolutionary thought of "survival of the fittest, survival of the fittest", PSO algorithm is to find the optimal solution through the cooperation between individuals. "At least in theory, a member of a biological group can benefit from the experience and discoveries accumulated by all other members of the group in the process of looking for food in the past [22]. This paragraph means that information sharing in biological groups will produce evolutionary advantages, which is the basic idea of PSO algorithm.

Imagine this scenario: a flock of birds are randomly searching for food. There is only one piece of food in this area. All birds do not know where the food is, but they know how far away they are from the food. This paper defines a quantitative index to quantify the population characteristics in the evolution process of PSO algorithm, record the historical quantitative data in real time, form a large number of time series, and provide input data for the function complexity classification model [23]. Similar to other algorithms, PSO algorithm can be used to solve most function optimization problems. Generally, these functions are very complex, mainly characterized by large scale, high dimension, nonlinearity, nonconvexity and nondifferentiability, and there are a large number of local optimal solutions. On the basis of ensuring the efficiency of the improvement strategy, the improvement strategy should be as simple and practical as possible. In addition, complex optimization strategies are not convenient for data analysis and summary. Simple optimization strategies are adopted to accelerate the program debugging process, improve the controllability of population characteristics, and make the population evolve towards the ideal evolution trend as much as possible [24]. PSO searches for the optimal solution in the feasible solution space by updating the position value through velocity. First, the particles in the population are initialized randomly, and the optimal solution in the population is found by iteration. It represents the self-learning ability of the particle itself, even if the particle is close to the best position it has experienced. The third part represents the social cognitive ability, which makes the particles close to the global optimal position in the population, representing the ability of mutual cooperation between particles. The flow chart of PSO algorithm is shown in Figure 1.

In the whole search process of PSO, the c_1 value is often set to be larger at the initial stage, so that the particles learn from the individual extremum in many ways and learn from the social extremum less, thus expanding the search range and avoiding falling into the local optimum. In the later stage, c_2 value is often set to be larger, which makes the particles approach the social optimal value and increases the local search ability. The original PSO (PSO) algorithm has attracted the attention of scholars since it was put forward, and it has been applied in various fields. Update the velocity equation as follows:

$$V_{ij}(t+1) = \omega V_{ij}(t), \tag{1}$$

where ω is the inertia weight, the larger the value of ω, the stronger the global search ability of the algorithm, and the smaller the ω, the stronger the local search ability of the algorithm.

In the early stage, ω should be set to a large value, while ω should be set to a small value in the later stage. In this paper, a method of linearly decreasing inertia weight is proposed, and its formula is

$$\omega = \omega_{\max} - n * \frac{\omega_{\max} - \omega_{\min}}{n_{\max}}, \tag{2}$$

where $\omega_{\max}$ and $\omega_{\min}$ represent the maximum inertia weight and the minimum inertia weight, respectively, n is the

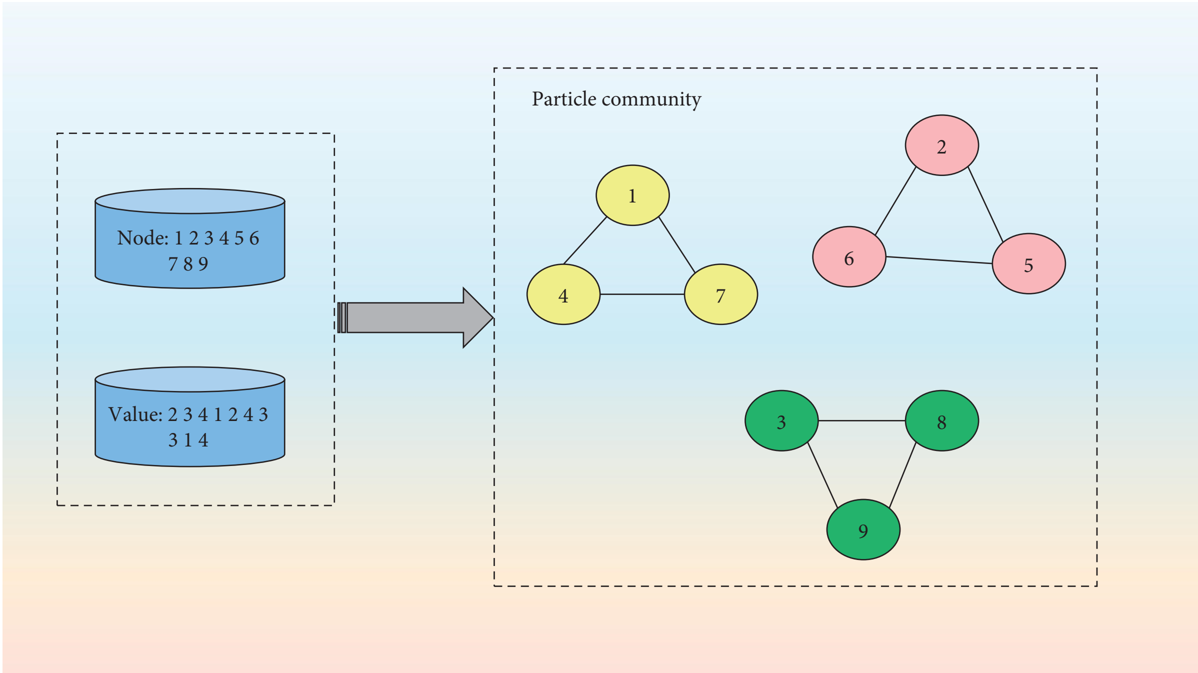

Figure 2: Schematic diagram of particle coding.

current iteration number, and n_{max} is the maximum iteration number. The values of ω_{max} and ω_{min} are generally 0.9 and 0.4, respectively, and the value of inertia weight will gradually decrease with the increase of iteration times.

The best position in the population is represented by index number g, that is. The velocity and position formula of particles in each generation are as follows:

$$v_{id}(t+1) = v_{id}(t) + c_1 \text{rand}. \tag{3}$$

In which: $i = 1, 2, \ldots m$; $d = 1, 2, \ldots, n$; rand is a random number that obeys the distribution.

Taking the adaptive parameters of time series as the main improvement strategy, the algorithm has obvious improvement effect, low program complexity, easy implementation, and quick implementation. Evolutionary strategy is

$$\begin{aligned}
v_i^{k+1} &= w^k \cdot v_i^k + c_1^k \cdot r_1, \\
x_i^k &= x_i^k + v_i^{k+1}, \\
w^k &= (w_{max} - w_{min}) \cdot (\text{MaxIter} - k), \\
c_1^k &= (c_{1m} - c_{1n}), \\
c_2^k &= (c_{2m} - c_{2n}),
\end{aligned} \tag{4}$$

where w_{max} and w_{min} are 0.9 and 0.5, respectively; c_{1m} and c_{1n} were 0.5 and 2.5, respectively; c_{2m} and c_{2n} were 2.5 and 0.5, respectively.

Based on the population evolution characteristic data of PSO, the given functions are classified according to their spatial complexity. The establishment of function complexity classification will help to qualitatively analyze the functions with unknown complexity characteristics and propose targeted optimization strategies based on the results of qualitative analysis, so as to further strengthen the optimization performance for a given function. In this paper, the idea of tag propagation is used to initialize the population. First, each particle in the network is set into a different community, and then iteration is carried out. For each particle, the community to which all its neighbors belong is recorded, and the number of communities to which it belongs is calculated, so that the node becomes the community with the largest number of neighbors as the community of this node. After this cycle for several times, the division of complex network has greater modularity. Experiments show that this initialization method can initialize the population well. In PSO, each particle in the population represents a solution to the optimization problem. Combining with the specific problems found in complex network communities, this paper proposes a particle coding method, and the schematic diagram of particle coding is shown in Figure 2.

According to the coding characteristics of PSO and inspired by binary PSO algorithm, this paper designs a new particle update algorithm to update each individual in the population. The value formula is as follows:

$$V_{ij}^{(t+1)} = \omega V_{ij}^t + c_1 r_1. \tag{5}$$

It is proved that taking c_1, c_2 as 1.494 can make the algorithm converge effectively. Set $y_i = (p_{\text{best}_i}^t > x_i^t)$ rule

$$\text{if}\left(p_{\text{best}_i}^t > x_i^t\right) y_i = 1. \tag{6}$$

Then, the value of $V_{ij}^{(t+1)}$ is brought into the function, the obtained value is calculated, and then the value is compared with the number between 0 and 1 randomly generated by the computer, and the value of V_{ij}^{t+1} is obtained.

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$$\text{if}\left(\text{rand}\,(\,) < S\left(V_{ij}^{(t+1)}\right)\right)\text{then}, \quad \text{else}\,V_{ij}^{t+1} = 0. \tag{7}$$

In this paper, a local iterative search updating method is designed, and the particles in the population will be updated according to V. The concrete steps are as follows: first, the value of V_{ij} is judged; if $V_{ij} = 1$ is found, the value of this node in the particle is iteratively changed into the values of all its neighboring nodes in turn, and the modularity of the particle after updating this node is calculated, respectively; if modularity is greater than that of the particle in the original population, the particle in the original population is replaced with the updated particle; otherwise, no replacement is carried out.

3.2. An Empirical Study of Syntactic Complexity and Semantic Coherence in Writing. Because the syntactic complexity and semantic coherence of writing have been tested in writing, the research on the relationship between syntactic complexity and semantic coherence summarizes the proficiency of writing or language. There is no strong and direct relationship between syntactic complexity and writing quality, but this does not mean that they are not related. Syntactic complexity is an important factor affecting writing. The study of syntactic complexity can bring some enlightenment to writing teaching. For diversity and syntactic structure in language output, diversity refers to the variation from complexity to shooting range sentence patterns, that is, the flexible and appropriate use of various sentence patterns; complexity refers to the complexity of sentence structure, that is, clauses, unrestricted verb phrases, compound verb phrases, compound verb phrases, noun phrases, and nominalized sentences. As the teaching and research of second language writing, the complexity of the relationship between syntax and language, the language level of second language learners, the process of language development, and the quality of writing have also become the focus of many second language studies. The objective syntactic complexity measurement is not significantly correlated with the subjective manual score, the syntactic complexity does not follow the “three-stage linear” development law, and different syntactic complexity measurement indicators are suitable for the evaluation of second language writing at different language levels.

With the passage of time, people put forward various methods to measure syntactic complexity and semantic coherence. Before expounding these measures in detail, the author will first define some unit and structure complexity measures used in syntactic analysis. The quantitative objects of unit length, unit density, and occurrence frequency of syntactic complexity are one of various sentence patterns. Unit length refers to the average number of words in the output unit, and the common ones are T unit length and clause length. T-unit refers to “the smallest unit that contains the main clause, all clauses and non-clause structures.” Various studies were reviewed: one of them was the intervention to increase the mortality rate, which studied the syntactic complexity and semantic coherence and its influence on the writing quality. The other was the research to examine the syntactic complexity of relations and the writing quality. Conclusion unit length and clause length seem to be a good predictor of writing quality, which may be due to other factors increasing T unit and clause length. Syntax complexity covers many aspects, including language output length, coordinate structure, subordinate structure, and nominalization.

These features are indicators to predict the development of English learners’ writing level. At present, more than 40 syntactic complexity measurement indicators have been used to describe the characteristics of these syntactic complexity. In addition, there is a significant relationship between syntactic complexity and writing quality, or each index of syntactic complexity can reflect writing quality to a certain extent. In studies using large amounts of data, it shows a linear relationship with proficiency. Other successful grammatical complexity measures also show that passive sentences, articles, relative clauses and compound nouns may be important structures relative to the level of development. Unit length and clause density can reflect the syntactic complexity and semantic coherence of students’ compositions. However, there are some syntactic features, such as adjective phrases, adverb phrases, and noun verb phrases. The use of these syntactic features will not only necessarily increase the unit length and clause density but also improve the degree of syntactic complexity. The use of subordinate structure of intermediate and advanced English learners is less than that of native speakers, but the use of compound nouns is close to or even more than that of native speakers. This finding is a challenge to the development law of “three paragraph” syntactic complexity. At the same time, it also needs to rethink the relationship between syntactic complexity and the writing quality of semantic coherence.

4. Results Analysis and Discussion

After the corpus collection, all Chinese students’ compositions. The evaluation and grading were conducted by three university writing professional raters. Therefore, it is confirmed that there is a strong correlation between grades x, y, Z and the average score, that is, the average score of raters x, y, and Z. Therefore, the final score of each article is composed of the average of the three scores given by three raters, that is, the average score. Correlation analysis of all writing scores. Check the relevance of all raters, as shown in Table 1.

In order to find out the differences of syntactic complexity and latent semantics between different proficiency levels, the author divided these 175 English compositions into two groups: according to the average scores of those English compositions, the first 23% were classified as high-scoring compositions, while the lowest 24% were classified as low-scoring compositions. In addition, in order to avoid misunderstanding of data by automatic software, formatting and spelling errors are eliminated.

This experiment compares the PSO algorithm with the accuracy of data mining algorithm, artificial intelligence algorithm, and decision tree algorithm on the syntactic

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Table 1: Correlation between grades x, y and Z and average score.

	Class X	Class Y	Class Z	Average
Class X		0.342	0.457	0.697**
Class Y	0.342		0.307	0.633**
Class Z	0.457	0.307		0.603**
Average	0.695**	0.633**	0.603**	

**The correlation is significant at 0.01 level.

complexity and semantic coherence of academic English writing. The experimental results are shown in Figure 3.

It can be seen from Figure 3 that the accuracy decreases with the increase of the number of experiments. Compared with other data mining algorithms, artificial intelligence algorithms, and decision tree algorithms, the accuracy decreases to a lower value. However, PSO algorithm can always better divide the syntactic complexity and semantic coherence of academic English writing. Even when the number of experiments increases and the number of experiments reaches 50, the PSO algorithm can still reach 48%. It can be seen that PSO algorithm has better clustering accuracy.

In this experiment, PSO algorithm, other data mining algorithms, artificial intelligence algorithm, and decision tree algorithm are used to divide the syntactic complexity and semantic coherence of academic English writing in its four real networks, and an error rate comparison is carried out. The experimental results are shown in Figure 4.

As can be seen from Figure 4, when the number of experiments is 40, the error rate of data mining algorithm is 58.3%, that of artificial intelligence algorithm is 53.4%, that of decision tree algorithm is 57.1%, and that of PSO algorithm is 47.1%. The modularity calculated by PSO algorithm can reach the best value among the other three algorithms. Therefore, PSO algorithm has better performance on syntactic complexity and semantic coherence of academic English writing.

The highlight of PSO is that it puts forward the idea of complexity and semantic coherence, which is beneficial to mining high-quality community structure even when the network structure is very fuzzy. The detail levels of different proficiency levels are summarized, as shown in Table 2.

As can be seen from Table 2, the writing data of all Chinese students and American students are saved in handwritten forms. It is necessary to input computer files to facilitate the data process. When inputing compositions with the keyboard, keep the original form of each article, including capital letters, punctuation, and even spelling and grammatical errors. In this case, the data should reflect the real quality of students' writing. After the above efforts, proofreading has been carried out to ensure keyboard input. Details of the data used in this study are shown in Table 3.

As can be seen from Table 3, the system can calculate 14 different syntactic complexity indexes by taking one sample as input for automatic measurement of syntactic complexity, which has been explored or proposed in the second language development literature. This system has achieved high reliability when processing data from written English corpus. This automatic corpus tool is used to calculate a set of syntactic complexity measures in a large number of large-scale corpus data, which eliminates the intensity of manual annotation and calculation.

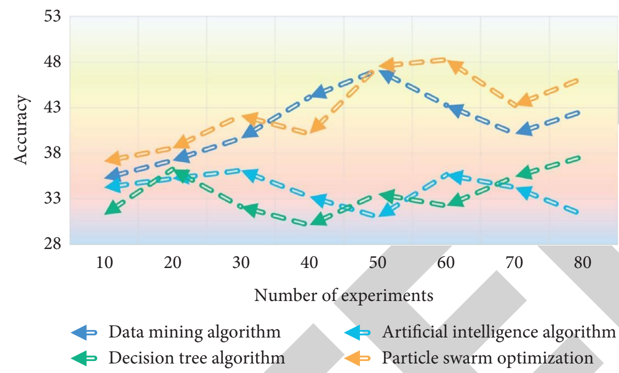

Figure 3: Comparison of accuracy between PSO algorithm and other three algorithms.

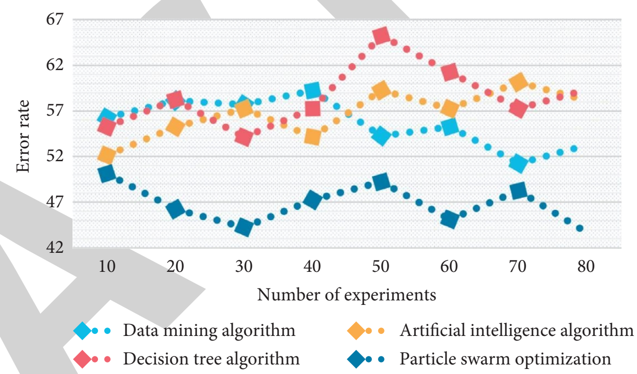

Figure 4: Comparison of error rates between PSO algorithm and other three algorithms.

Table 2: Summary of details of different proficiency levels.

Group	Article count	Score range
High grouping	44	>87.751
Low grouping	43	<83.624

Table 3: Data summary.

Group	Ns	NNS	NNS-high	NNS-low
Number of writing	51	203	105	102
Average writing length	151.73	133.21	147.32	119.13
Total words	7,586	26,643	14,731	11,913

This experiment explores the syntactic complexity and semantic coherence of academic English writing and makes experiments on the development patterns of simple sentences, complex sentences, and complex sentences. The experimental results are shown in Figure 5.

As can be seen from Figure 5, simple sentences account for the largest proportion in the total number, and the sentence types used in students' compositions are followed by compound sentences. In contrast, the proportion of compound sentences and compound sentences is quite large compared with the first two. This result is consistent with the research results, which shows that the overuse of simple

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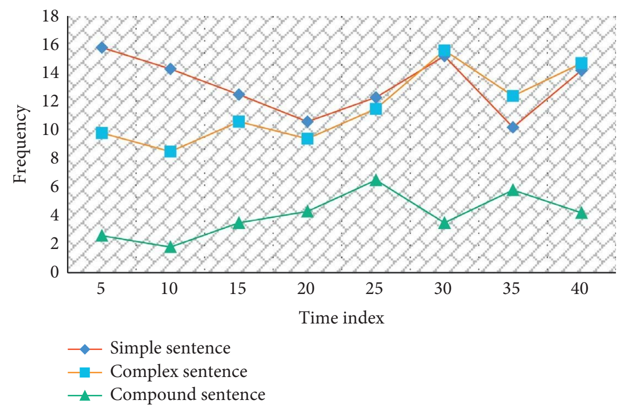

Figure 5: Development trend of three independent sentences.

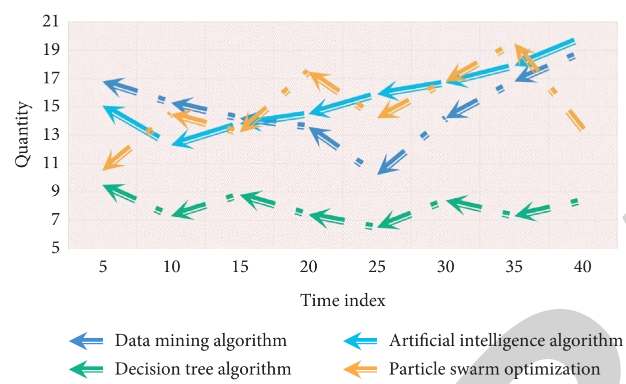

Figure 6: Trends of complexity and semantic coherence under different algorithms.

sentences is a common reality in China. In order to show more clearly how to use the three basic sentence types.

In this experiment, PSO algorithm, data mining algorithm, artificial intelligence algorithm, and decision tree algorithm are used to study the changing trend of syntactic complexity and semantic coherence of academic English writing. The experimental results are shown in Figure 6.

As can be seen from Figure 6, all three algorithms show an upward trend, and the decision tree algorithm hardly rises. The decision tree algorithm written for the first time is 9.2143, the maximum value of PSO algorithm is 19.2148, and the minimum value is 11.1254. Therefore, great changes have taken place from the minimum value to the maximum value. The research results of the change trend of data mining algorithm and artificial intelligence algorithm are the same, showing obvious growth trend, and both of them have almost increased greatly.

In this experiment, the correlation between the indexes of syntactic complexity and semantic coherence and writing achievement is studied, and the data mining algorithm, artificial intelligence algorithm, decision tree algorithm, and PSO algorithm are used to make experiments. The experimental results are shown in Figure 7.

It can be seen from Figure 7 that the number of phrases is related to the writing performance. When the number of experiments reaches 25, the significant value of data mining

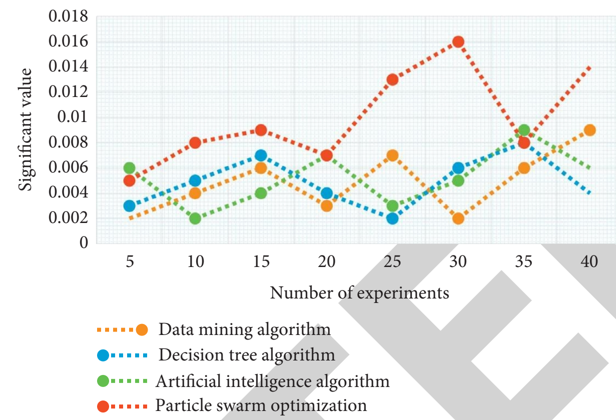

Figure 7: Correlation between sentence complexity and semantic coherence and writing performance.

algorithm for syntactic complexity and semantic coherence is 0.008, the significant value of artificial intelligence algorithm is 0.003, the significant value of decision tree algorithm is 0.002, and the significant value of PSO algorithm is 0.013. It can be seen that PSO algorithm is the best.

5. Conclusions

This paper studies the syntactic complexity and semantic coherence of academic English writing based on PSO algorithm. The number of phrases is related to the writing performance. When the number of experiments reaches 25, the significant value of data mining algorithm in syntactic complexity and semantic coherence is 0.008, the significant value of artificial intelligence algorithm is 0.003, the significant value of decision tree algorithm is 0.002, and the significant value of PSO algorithm is 0.013. It can be seen that PSO algorithm is the best. Syntactic length and phrase number are related to writing quality, while syntactic density is not related to writing quality; there are significant differences in syntactic length and the number of phrases between the groups with high and low writing scores; students use more clauses in writing; syntactic complexity and semantic coherence can predict writing performance; and the number of phrases can significantly predict writing performance. PSO has certain enlightenment and guiding significance for English writing teaching. Through the training of writing strategies such as sentence pattern conversion, the use of complex noun phrases and verb diversity expression will help to improve the students' syntactic complexity and composition quality. The syntactic complexity and semantic coherence under PSO algorithm have a certain impact on the quality of writing, especially the length index and the number of phrases. Teachers should encourage students to use various syntactic structures and increase the diversity of composition structures in writing teaching.

Data Availability

Data are available on request from the corresponding author.

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Conflicts of Interest

The authors declare that they have no conflicts of interest.

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