





## The Ecological Tutoring System Construction Path of College English Writing Open Course Teaching with Intelligent CAD

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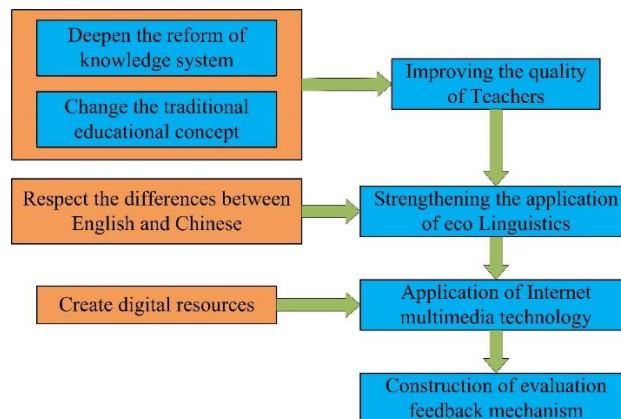
**Abstract:** Ecological linguistics has been developing rapidly worldwide for a long time. In recent years, it has also attracted the attention of many scholars in China. In practice, it has been gradually applied to the construction of college classrooms. It is essential to care about learning anxiety in college English writing classes because it is directly related to student's academic performance, personal development, and mental healthcare. From the perspective of ecological language, this paper analyzes the problems existing in the construction of the current English writing ecological classroom. It proposes to protect the ecological nature of language by respecting the differences between Chinese and English thinking and discourse. English education has been paid more and more attention, and writing is an important part of it. Automatic composition scoring can solve many of the problems associated with traditional manual marking. The automatic composition scoring system cannot really understand the composition. Therefore, mining deeper features hidden in the data has a great impact on improving the effectiveness of the system. A good article always has a special high-level logic and topic structure, in which the actual choice of words and sentences and their arrangement serve this high-level structure. From the perspective of language ecology, this paper proposes an algorithm for computing the smoothness of deep sentences, which integrates multiple features. At the same time, in order to solve the problem of high complexity and low efficiency in the traditional way of using a similarity matrix to model the relationship between sentences, we introduce the self-attention mechanism to investigate the relationship between the current type of sentence vectors and other sentence vectors.

**Keywords:** Tutoring Systems; Intelligent CAD; Automatic composition scoring; Multiple features

**DOI:** <https://doi.org/10.14733/cadaps.2025.S8.146-159>

## 1 INTRODUCTION

Ecological language, also known as language ecology, is a new subject that integrates ecology and linguistics and is also a branch of linguistics. In the past, linguistics regarded the language system as a closed structure, while ecological language regarded the language as an open system and believed that the use of language and the external environment were interrelated and interactive [1]. Later, some scholars infiltrated the principles and methods of ecology into the field of language, such as "ecological linguistics" or "language ecology". Since then, more scholars have studied the relationship between language and the ecological environment, which has promoted the research process on language and ecological issues. The second model focuses on the ecological environment factors that affect the function of language, pointing out that the living environment of language depends on the use and the attitude of users, and the ecological environment is conducive to the sustainable development of language [2]. To extend the language ecology to English writing teaching, English teachers should integrate the foreign language ecosystem and make a deep analysis of the ecological status, development, and changes of the factors that affect teaching in the system. The system of language teaching students forms a comprehensive, balanced, and sustainable environment. Within the ecosystem, various environments interact, restrict, and depend on each other. Teachers must break the traditional time constraints in English writing teaching [3-4]. The reconstruction strategy of English writing ecological classrooms in high colleges is shown in Figure 1.



**Figure 1:** The reconstruction strategy map of English writing ecological classroom.

The increase in the number of students causes confusion between the teaching environment and the normal number, which does not conform to the principle of moderation [5]. It is also difficult for students to get more detailed guidance from teachers, which leads to an imbalance between teachers and students and the classroom ecological environment in the classroom. Teachers are the main body of education in the classroom, while students are the main body of education. Teachers and students, as dual ecological subjects, participate in the whole process of education and become one, which is the main body of teaching activities. In the past, objective epistemology and constructivism theory were used as the basis of classroom teaching. At present, the teaching mode of the English writing classroom is still based on Teachers' indoctrination, the content is based on textbooks, and the teaching content is based on the narration of theoretical knowledge [6]. This kind of classroom model is traditional, single, and lacks innovation, which greatly affects the cultivation of learners' autonomous learning ability and the improvement of their innovative thinking ability. At the same time, due to the influence of school resources and teaching time, there are few opportunities for

classroom practice teaching, and students' participation has not been effectively valued, resulting in the imbalance between teaching practice and classroom theory [7].

In the context of eco linguistics, we should respect the differences in thinking and discourse between English and Chinese and protect the ecology of language. By adopting modern information technology, constructing a mixed teaching mode, adopting a multimodal discourse teaching method, and taking micro classes as the carrier, we can achieve the balance of the English writing classroom ecosystem and the ecological transfer of students' writing ability [8]. From the perspective of language ecology, this paper proposes an algorithm for computing the smoothness of deep sentences, which integrates multiple features. At the same time, in order to solve the problem of high complexity and low efficiency in the traditional way of using a similarity matrix to model the relationship between sentences, we introduce the self-attention mechanism to investigate the relationship between the current type of sentence vectors and other sentence vectors.

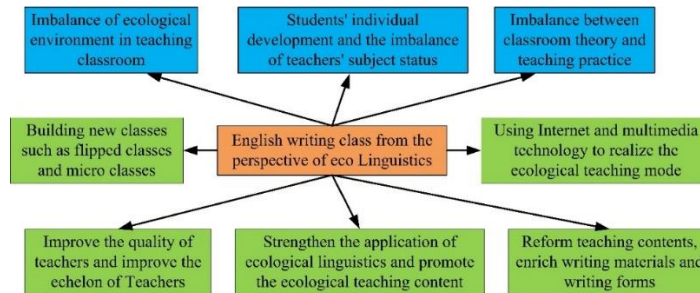
## 2 RELATED WORK

### 2.1 Reconstruction Strategies for Writing Ecological Classroom

Only by improving the quality of college teachers can we improve the whole teaching team and help the reconstruction of the ecological classroom of English writing in higher vocational colleges. First of all, teachers should deepen the reform of the knowledge system, which is the foundation of classroom teaching [9]. Because each teacher has different knowledge system composition and knowledge level, only by deepening the reform of English teachers themselves can they keep up with the pace of social development and provide better teaching services for students. We should not only actively enrich our own knowledge system but also explore and better summarize the knowledge points that are beyond the outline and should be mastered to varying degrees. We should also expand our knowledge in our spare time [10]. The traditional teaching method mainly cultivates the students' exam-oriented ability. They should keep pace with the times and actively plan and develop scientifically in English teaching. Otherwise, they will be eliminated by the times.

Sometimes, we can learn more from the teaching methods of various English training institutions, which can not only enhance the interest in teaching and improve students' enthusiasm for learning English but also enable students to better master and apply the overall language learning in a fun environment. Therefore, the construction of a teachers' team is an important link in the construction of an ecological classroom. Teachers should also learn to innovate teaching methods [11]. The teaching ecological environment is constantly changing, and teaching methods should change with the change in the environment. There are great differences between learning English and Chinese. Learning Chinese pays more attention to the integrity of the language, and the comprehension ability of students pays more attention to the relationship between sentences, which contains more combinations of rational thinking and perceptual thinking. In the arrangement of language, start from the small details and leave the key content to the last. However, English pays attention to the expression of personality, with few perceptual parts [12]. It tends to adopt thinking modes such as reasoning, proof, and explanation, focusing on individual value. It is usually a one-way thinking mode starting from the individual. Students will spend far more time learning Chinese than English. Due to the long-term influence of Chinese culture and the Chinese environment, mature Chinese thinking has been formed. English is a second language, and it is basically only contacted after primary school [13]. Therefore, there are certain difficulties in the formation of English thinking. The differences between the two thinking languages have also brought great difficulties to the teaching of English writing in higher vocational colleges. There are also great differences between English and Chinese writing in terms of text style. Chinese texts are mainly euphemistic and implicit. The theme of the article is progressive layer by layer, and large words are

often used to pave the way, thus leading to the theme of the article [14]. English is usually relatively simple and direct. In the beginning, the key points of the article will be highlighted, followed by secondary information. In writing class, teachers should teach according to the characteristics of English writing, analyze the differences between English and Chinese ways of thinking, and then protect the ecology of the language. The English writing class from the perspective of eco linguistics is shown in Figure 2.



**Figure 2:** The English writing class from the perspective of ecolinguistics.

In the process of teaching, we should lead or guide students to read English articles, cultivate students' English thinking, help students develop good reading habits, and then develop English writing thinking so as to avoid the influence of Chinese thinking [15]. When writing, learn to design and layout according to the characteristics of English writing, and finally cultivate the ability to write English articles independently. Teachers also need to teach students to compare English and Chinese, understand and discover the differences by themselves, and cultivate students' awareness of the differences between English and Chinese. Secondly, teachers need to strengthen English grammar teaching and enrich students' vocabulary and grammar knowledge. When writing, students often show that the writing content is empty, the theme is not clearly expressed, the details of the article are not fully reflected, the internal logic is chaotic, the writing ideas are not clear, and the depth is not enough, which is finally reflected in the weak ability of comprehensive use of English. Therefore, teachers must reform the teaching content of English [16]. First of all, teachers should effectively guide students' reading, cultivate their extensive reading habits, and promote the improvement of writing ability through reading. A large number of readings will enrich students' vocabulary. The formation of a standardized manuscript format will also lead to a deeper understanding of the structural framework of the article and enrich English writing skills. In understanding the central idea of the article, the author's writing intention or expressed emotion exercises students' self-thinking ability [17]. At the same time, it also accumulates a lot of writing materials to lay a good foundation for later English writing and establish a solid language reserve.

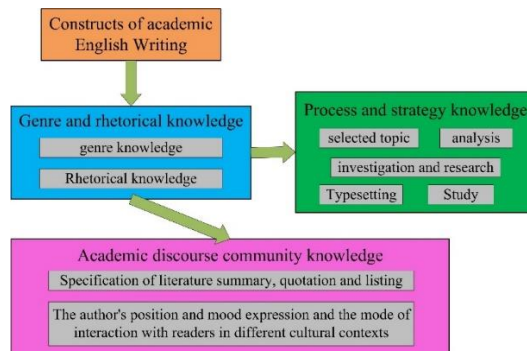
The relief of learning anxiety can significantly improve students' writing ability and learning efficiency, enabling them to express their thoughts and opinions more confidently. This confidence building helps students to show a more positive attitude in other subject areas as well, thereby improving overall academic performance. In addition, through effective care and support, students' critical thinking and creative expression skills are also cultivated, which is essential for their future academic research and career development. At the same time, reducing learning anxiety also helps to maintain students' mental healthcare, reduce the negative impact of stress and anxiety on their studies and lives, and promote students to form healthy learning habits and lifelong learning abilities. In the context of globalization, good English writing skills are particularly important for cross-cultural communication and international cooperation, so caring for learning anxiety can also help students better adapt to the multicultural environment and cultivate their cross-cultural communication ability. Finally, caring for learning anxiety helps to achieve the fundamental goal of education, that

is, to cultivate students' comprehensive abilities so that they can become lifelong learners and active participants in society and contribute to the development of society.

## 2.2 Assessment of English Writing Ability Development

Eco linguistics is a branch of linguistics that is a combination of ecology and linguistics. Unlike traditional linguistics, which regards the language system as a self-contained structural system, eco linguistics holds that the language system is an open ecosystem; language, language use, and the external environment are interdependent and interactive [18]. Scholars define writing in the social context as a system of knowledge that includes content knowledge, general knowledge, formal knowledge, condition or procedure knowledge, task-specific knowledge, and discourse community knowledge [19].

On the basis of writing constructs, scholars further clarify that writing ability includes five knowledge contents, especially the knowledge of the discourse community. They believe that good writers can analyze and respond to the values and expectations of specific readers in the writing. The knowledge of the discourse community determines the genre, rhetoric, theme selection, and writing process of writing. For the knowledge of writing constructs, scholars believe that metacognitive knowledge is the basis of applying all kinds of knowledge [20]. The reflective diary in the writing portfolio assessment model is a way for students to show the development of metacognitive knowledge. The developmental and multidimensional writing constructs challenge the result-oriented summative writing assessment, which gradually turns to the process and interactive mode [21]. The assessment model constructs the whole learning process, creates learning activities, and guides all aspects of learning. Dynamic assessment is a general term for a series of assessment methods, also known as learning potential assessment. The theoretical basis of dynamic assessment is a social and cultural theory [22]. The purpose is to explore and discover the students' recent development zone through the interaction between evaluators and students. It mainly provides support for students learning through intervention or interactive intervention. The dynamic evaluation system of writing is still under construction, and the existing studies have focused on the theory and practice of intervention scaffolding intervention, interactive feedback, and the combination of intervention and interactive writing portfolio evaluation [23]. Teachers strategically use summative assessment methods while emphasizing formative feedback, students' reflection, and students' understanding of assessment criteria and guiding students' continuous participation in the writing process according to specific steps [24]. In the process of students' writing multiple drafts, teachers identify and respond to the aspects of students' writing that need guidance through e-mail feedback and give help to the development of students' academic writing ability [25]. The conceptual framework of academic English writing is shown in Figure 3.



**Figure 3:** The conceptual framework of academic English writing.

In other words, language users themselves, the interaction between language users, and the interaction between language users and the environment will all affect the development of language ability. Therefore, the ecological assessment model takes into account the writing group, writing place, time, and other environmental factors, uses a variety of data collection methods, shares data, and analyzes the assessment results to a certain extent [26].

### 2.3 The Construction of English Writing Ecological Classroom

Like other courses, writing class is an ecosystem composed of various factors. The ecological elements are open, balanced, and mutually restricted. Only when the writing course is in a dynamic and balanced development process can it produce good teaching results. The flipped classroom is a new teaching concept. Its teaching design is based on cooperative learning theory and constructivist learning theory [27]. With humanism as the guiding ideology, it fully embodies the education and teaching concept of "student-centered, all for students" and constructs an ecological classroom that deepens knowledge and dynamically grows. The hybrid teaching mode is to combine the advantages of traditional learning methods with the advantages of digital and network learning [28].

The focus on the development of academic writing ability in the construction of academic English writing has shifted from text reflection to humanistic interaction, focusing on learners' writing style, reasons, cognitive characteristics, cultural background, and other factors [29]. Therefore, the assessment of academic English writing has entered the field of ecological dynamic assessment. Under the project-driven process writing classroom teaching environment, the academic English writing course adopts ecological dynamic assessment means in different ecological environments of teachers and students; students and students themselves integrate different assessment means with interactive teaching mode, implements ecological dynamic classroom teaching and assessment, and realizes the ecological transfer of genre and rhetoric knowledge, process and strategy knowledge, and academic discourse community knowledge [30]. Teachers analyze writing books and students' writing experience and resources through students' electronic writing portfolios, thus further promoting the ecological dynamic assessment of academic English writing ability [31].

## 3 DESIGN OF APPLICATION MODEL

### 3.1 Introduction to Relevant Basic Knowledge and Theories

Smoothness is the key attribute of text, and modeling the structure of the fluent text is an important problem in natural language processing. In automatic composition scoring, a good article always has a special high-level logic and topic structure, in which the actual choice of words and sentences and their arrangement serve this high-level structure. Our main goal is to build a model to learn this structure by arranging a set of given sentences to form a coherent text. The traditional methods usually use the direct fusion of sentence vectors or use one or more similar matrices to model the relationship between sentences, which has high computational complexity and makes it impossible to establish a similar matrix between every two sentences. We introduce the self-attention mechanism to investigate the relationship between the current vector and all other vectors in the same layer, which can model and deal with the relationship between each two-sentence vector well, and the computational complexity is low.

Global vectors for word representation is a method for word vector training through text word co-occurrence matrix and co-occurrence probability matrix. It combines many advantages of traditional word vector training word2vec and adds its own characteristics. The minimum mean square error function is used to construct the loss function, and its mathematical expression is as follows.



$$f(x) = \begin{cases} \left(\frac{x}{x_{max}}\right)^\alpha & \text{if } x < x_{max} \\ 1 & \text{otherwise} \end{cases} \quad (1)$$

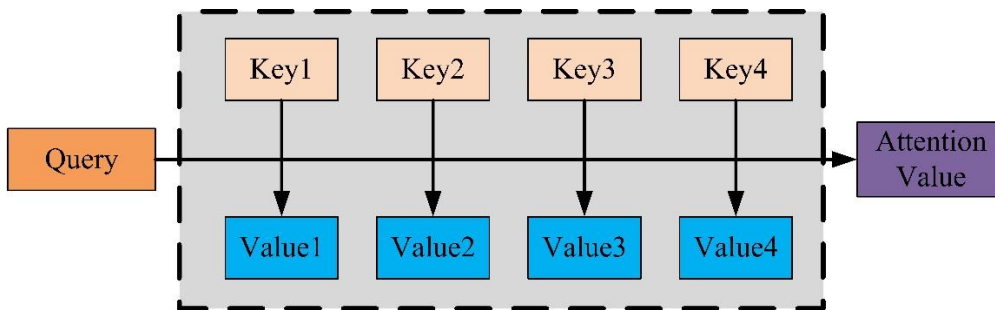
Knowledge base establishes entities, relationships, and complex semantic associations among them. Therefore, knowledge representation learning can be constructed through representation learning. Therefore, the following loss function is defined:

$$f_r(h, t) = \frac{|l_h + l_r - l_t|}{L_1/L_2} \quad (2)$$

The objective function is as follows, and the maximum interval method is adopted.

$$L = \sum_{h,r,t \in S} \sum_{h',r',t' \in S'} \max(0, f_r(h, t) + \gamma - f_r(h', t')) \quad (3)$$

The proposal for attention mechanisms comes from the study of human visual mechanisms. The eye can not notice all the information when observing things; it only focuses on specific areas. This idea has been extended to the construction of a deep neural network. The structure of the attention mechanism is shown in Figure 4.



**Figure 4:** The structure of the attention mechanism.

The deep sentence smoothness algorithm based on multi-feature fusion proposed by us mainly includes two parts: in the first part, many features are used to vectorize the words, and then a variety of different sentence representation matrices are formed to form the input layer. The second part is the network structure of the smoothness algorithm, which is used to extract features and model the relationship between sentences. We divided the documents into the following groups.

$$\langle s_1, s_2, s_3 \rangle, \langle s_2, s_3, s_4 \rangle, \dots, \langle s_{N-2}, s_{N-1}, s_N \rangle \quad (4)$$

Sentences are made up of words and can be represented by a matrix. The sentence matrix can be expressed as:

$$S = \begin{bmatrix} w_1^i, w_2^i, \dots, w_{|s|}^i \end{bmatrix} \quad (5)$$

Thus, for each word vector representation, we get the corresponding sentence matrix. The entities of the dataset contain most of the commonly used words. In the process of constructing the sentence

matrix, if a word that does not appear in the entity is encountered, the word vector of the word is constructed by random initialization. For each element in the vector, it is calculated as follows:

$$c_j = S^* F_i = \sum_{k,q} S_{[:j-m+1:j]} \otimes F_{kj} \quad (6)$$

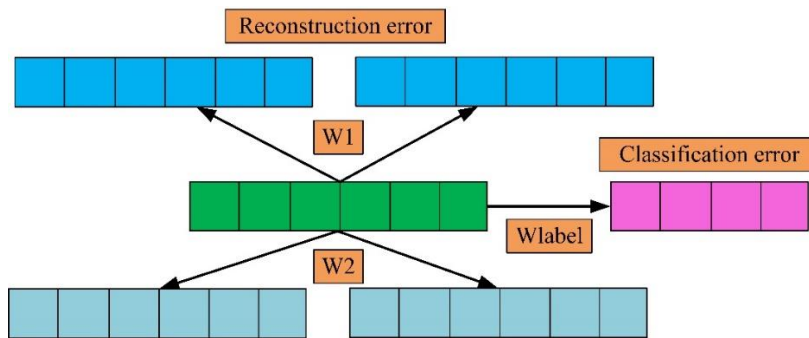
For the self-attention layer, we use the self-attention mechanism to model the relationship between sentences. The specific calculation method of the self-attention layer is as follows:

$$\text{Attention } Q, K, V = \text{Softmax} \left( \frac{QK^T}{\sqrt{d_k}} \right) V \quad (7)$$

Scale transformation is used to prevent training instability caused by an input value that is too large, and masking is used to ensure the sequence of time. For the output layer, we make the final classification and judgment on the sentence smoothness. The mathematical expression is as follows.

$$p_{y_q | h^k} = \text{Sigmod } W_s h^k + b_s \quad (8)$$

To be applied to classification or regression tasks, the self-encoder needs to extract the specific feature structure. The error diagram of the recursive self-encoder is shown in Figure 5.



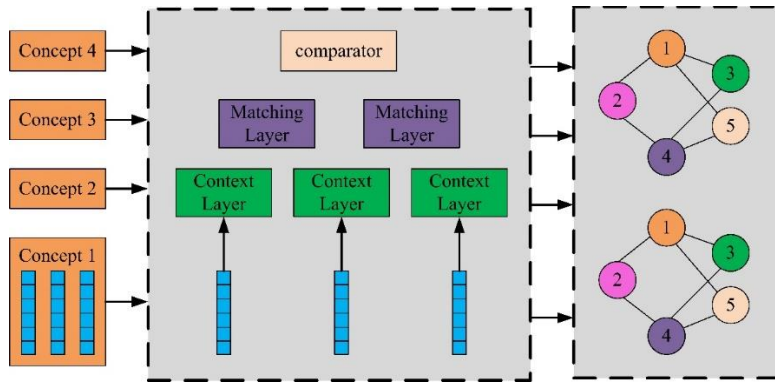
**Figure 5:** The error diagram of a recursive self-encoder.

That is, we calculate the product of the group smoothness probabilities into which the document is divided to represent the smoothness of the whole document. In this way, any number of inconsistent groups in a document may have a great impact on the results. The self-encoder can extract the specific structure in the node.

### 3.2 Sentence Smoothness Calculation Based on Multi-Feature Fusion

Features are extracted by convolution. For sequence information such as natural language, it is a one-dimensional structure. The recursive neural network is used to extract the structural features of the article. In the second part, the sentences are clustered, and the sentence vectors from the three documents are combined to form a concept. The third part is used to construct the vertices and edges of the graph in the graph convolution network. The fourth part includes the graph convolution network layer, the next multi-layer perceptron layer, and the output layer, which are used to train the vertex feature vectors and then obtain the similarity features of documents. The construction of the text-matching network is shown in Figure 6.





**Figure 6:** The construction of a matching network.

The following formula defines the calculation formula of the graph convolution operator:

$$h_i^{l+1} = \sigma \left( \sum_{j \in N_i} \frac{1}{C_{ij}} h_j^l w_{R_j}^l \right) \quad (9)$$

The purpose of weight sharing is to reduce the number of parameters and the complexity of the model. At the same time, the vectors of two different spatial dimensions are mapped to the same spatial dimension so that their data distribution is consistent, and different vectors are encoded on the same spatial dimension. The distance between the reference sample and the negative sample is defined as follows:

$$d_- = \frac{e^{\text{Net } x - \text{Net } x^-^2}}{e^{\text{Net } x - \text{Net } x^-^2} + e^{\text{Net } x - \text{Net } x^+^2}} \quad (10)$$

The distance between the reference sample and the positive sample is defined as follows.

$$d_+ = \frac{e^{\text{Net } x - \text{Net } x^+^2}}{e^{\text{Net } x - \text{Net } x^-^2} + e^{\text{Net } x - \text{Net } x^+^2}} \quad (11)$$

The objective of the optimization is as follows.

$$\text{comparator} = \|d_+, d_- - \text{margin}\|_2^2 \quad (12)$$

However, the actual situation is that some positive samples are not so similar, and some negative samples are also very similar, so it is easy to overfit, so a reasonable value should be set for the margin.

#### 4 EXPERIMENTS AND RESULTS

First, the sentence vector is pre-trained to make the sentence vector capture the structural characteristics of the article. The recursive self-encoder is used to pre-train the sentence vector. The paper abstract data set is selected as the positive sample with good structure, and the sentences in

the data set are randomly replaced to generate negative samples as the samples with poor structure. Each node of the input layer of the recurrent neural network is a sentence vector. The statistics of the final dividend data set are shown in Table 1.

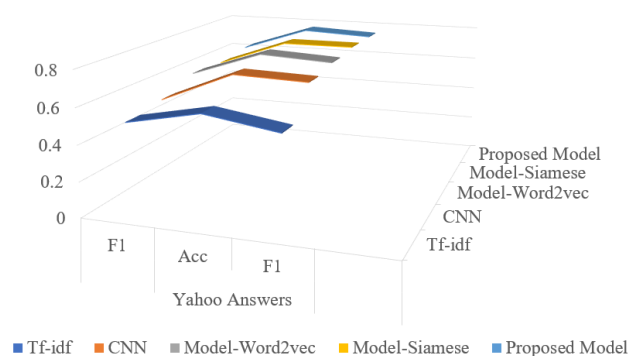
<i>Data set</i>	<i>Training set</i>	<i>Validation set</i>	<i>Test set</i>
Time span	18 months	2 months	1 month
Number of messages	49102	6950	3650

**Table 1:** The statistics of the final dividend data set.

It contains the question description and corresponding answers. Previously, it was used as a data set for short-text and long-text matching. This experience can help us understand the binary classification problem of whether the two documents match. The results obtained from the experiment are shown in Table 2 and Figure 7.

<i>Method</i>	<i>AREA</i>		<i>Yahoo Answers</i>	
	<i>Acc</i>	<i>F1</i>	<i>Acc</i>	<i>F1</i>
Tf-idf	0.534	0.51	0.593	0.53
CNN	0.573	0.54	0.713	0.70
Model-Word2vec	0.611	0.61	0.752	0.73
Model-Siamese	0.614	0.60	0.749	0.75
Proposed Model	0.626	0.63	0.769	0.75

**Table 2:** The results obtained from the experiment.



**Figure 7:** The results obtained from the experiment.

In fact, as the answers to the same question, most of the different answers have semantic matching. After preprocessing the data set, about 20000 pairs of similar answers were selected as positive

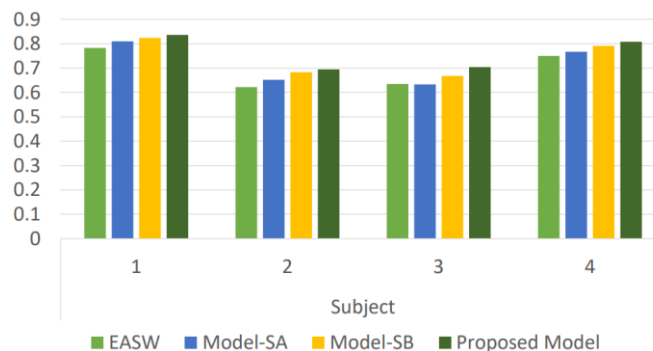
samples. Compared with the traditional algorithm based on CNN, our network also has obvious effect advantages, which proves that the graph neural network is more suitable for modeling long text-matching tasks. Compared with the model model-word2vec without sentence vector pre-training, our model has better accuracy, which shows that the structure information of text can be well obtained by using a recursive self-encoder for sentence vector coding

In the text-matching degree calculation algorithm, we have modeled the semantic matching relationship between the composition and the model text. We can extract a hidden layer vector in the final multi-layer perceptron, which represents the semantic matching degree feature of the two texts. This feature combines many features of our Chapter 4 semantic matching degree calculation network and can be regarded as an overall representation of the article. Therefore, the features extracted from the multi-layer perceptron layer and the LSTM can be treated equally. The experimental results of the automatic composition scoring algorithm are shown in Table 3 and Figure 8.

<i>Method</i>	<i>Subject</i>			
	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>
EASW	0.783	0.622	0.635	0.750
Model-SA	0.810	0.652	0.633	0.767
Model-SB	0.824	0.683	0.668	0.791
Proposed Model	0.836	0.695	0.704	0.808

**Table 3:** Experimental results of automatic composition scoring algorithm.

As shown in the experimental results, all the algorithms, including the ease algorithm, have achieved relatively good results, which shows that through a good feature selection, the traditional machine learning algorithm can also deal with the automatic composition scoring problem well. At the same time, it proves that the automatic composition scoring task can model this problem well by manually selecting many text features and some deep-seated features; it also explains the reasons why the two deep-seated features, sentence smoothness, and text matching, which we have specially selected, have achieved good results.



**Figure 8:** Experimental results of automatic composition scoring algorithm.

This chapter first introduces the implementation of the overall automatic composition scoring system, including the basic algorithm, engine, and interface layers. It is used to get the sentence smoothness score, text matching score, and total score according to the user's requirements. Then, we focus on our automatic composition scoring algorithm, which skillfully combines the characteristics of sentence smoothness and text matching. We have carried out comparative experiments on the data set to prove the algorithm's good effect.

## 5 CONCLUSIONS

English writing teaching is a systematic ecological project that takes students as the main body and teachers as the leading role. It also gives full play to the two-way or multi-directional interaction of other ecological factors. Guided by the concept of ecological language teaching and based on systemic functional linguistics, this paper discusses the ecological teaching of English writing in Higher Vocational Colleges from the aspects of teaching idea, teaching content, teaching method, teaching mode, and evaluation system, which provides new ideas and methods for the teaching of this course. It can give full play to the role of various ecological factors in writing teaching, maintain the vitality of writing classroom teaching, realize the sustainable development of writing teaching, and cultivate students' writing ability and speculative ability. From the perspective of language ecology, this paper proposes an algorithm for computing the smoothness of deep sentences, which integrates multiple features. Experiments show that our proposed algorithm has good results.

It is of great educational significance and practical value to study the treatment of learning anxiety in college students' English writing classes. First, it helps to improve students' writing ability and academic achievement by reducing anxiety; students are able to express ideas more confidently and deepen their understanding of the writing task. Second, this study promotes the overall mental health and well-being of students, as relief from writing anxiety translates into positive attitudes and emotional management skills in a broader learning context. In addition, by researching and implementing effective healing strategies, educators are able to understand the needs of students better, optimize teaching methods, and create more inclusive and supportive learning environments. Ultimately, this study will not only enhance students' English writing skills but also develop their self-directed learning, critical thinking, and creative expression, laying a solid foundation for their future academic and professional careers. This paper focuses on automatic composition scoring technology, especially scoring-related sentence smoothness calculation technology, and text matching calculation technology. We have achieved some results in these fields, but there are still shortcomings and room for progress. The ecological dynamic evaluation system for the development of academic English writing ability is still under construction. For example, the description and evaluation of the two modules of process and strategy knowledge and academic discourse community knowledge need to be further improved so as to more effectively promote students' improvement, including literature research ability. The end-to-end automatic composition scoring algorithm combined with other deep feature knowledge has achieved good results. If necessary, it can be displayed visually to increase the interpretability of the model.

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