



Evaluation of the Sustainable Development Path for English Teaching in the Context of Ecological Environment

Shuling Yang¹ and Haiyan Peng^{2,*}

¹ School of Foreign Languages, Jilin Normal University, Siping 136000, Jilin, China

² School of Foreign Languages, Guangzhou Huashang College, Guangzhou, 511300, Guangdong, China

SUMMARY: *English teaching is one of the key elements of education, and the progress and trends of reforms in English teaching are of great interest to everyone. Promoting the all-round development of English teaching helps to strengthen students' long-term learning ability and application of English in their daily lives, thus enhancing their adaptation skills for life in society. However, the traditional teaching model cannot meet the demands of students for enhanced English learning ability in their all-round development due to deficiencies in actual teaching and learning. Therefore, this paper will explore the path of sustainable development for English teaching. Based on the theory of educational ecological environment, this paper proposed a teaching model for sustainable development and conducted experiments on it from multiple angles. The research shows that when using the sustainable development teaching model in teaching, the students' emotional response to English learning increased by 3.73 per cent and their ability to apply English knowledge in practice improved by 5.33 per cent. The students' English learning efficiency, English learning level and satisfaction have also increased.*

KEYWORDS: *Educational Ecological Environment; English Teaching; Emotional Engagement Level; Sustainable Development Learning Ability*

1 Introduction

English is a relatively widely spread language, and for most people learning English, it is a very useful one. The deepening of economic globalisation has led to an increase in the demand for English-speaking professionals in society, and as a result, higher quality educational standards are now required. The study of the sustainable path for teaching and the promotion of students' learning ability in sustainable development can help improve the application of English knowledge by students and meet the needs of social and economic development for English practical talents. Therefore, this paper studied how to achieve the sustainable development of English teaching in conjunction with the concept of educational ecological environment.

Sustainable learning supports the students' desire to study and boosts their motivation. Many scholars have studied the problems of sustainable development in education. Amin M A has studied the sustainable development of English teaching in light of the deficiencies in traditional teaching for raising students' interest [1]. Bekteshi E conducted an experiment on teaching sustainability and found that, under the conditions of sustainable development of

*yangshuling@jlnu.edu.cn

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English teaching, it was beneficial to foster a positive affective attitude in students towards learning English; thus, students could spend more time and energy on learning English [2]. Chen B studied the sustainable development of piano teaching and proposed some countermeasures to achieve the sustainable development of piano teaching; this provided a reference for other scholars [3]. Dixit S believed that teachers' knowledge and attitudes towards sustainability were sometimes limited and unscientific, and put forward the idea that teachers should be concerned with cultivating students' active learning spirit [4]. Feng Y studied ethnic dance teaching based on the concept of sustainable development and proposed suggestions for promoting the sustainable development of ethnic dance teaching in cultural centers [5]. Zhang YX put forward some proposals for the sustainable development of English teaching teams in private schools [6]. After studying the teaching sustainability in a certain area, Abozaied put forward some countermeasures to achieve English teaching sustainability and created a good learning environment for students in this area to learn English [7]. In short, many scholars have studied how to realise the development of teaching in harmony with sustainable development and how it can motivate students to learn English more voluntarily.

A good Educational Ecological Environment can help improve teaching by teachers. Many scholars have studied the educational ecological environment. Cai C M investigated the connection between the enthusiasm of physical education teachers' work and the educational ecological environment [8]. Xiao H studied the general plan and design of the campus [9]. Yang F L built an educational ecological environment model based on multiple regression analysis and improved the internal and external governance levels of the educational ecological environment [10]. Li F used the network platform for art education and teaching, and built an ecological environment for art education based on the network platform. Based on the above experiments, it has been verified that students can develop higher-level thinking and enhance their artistic capabilities in this educational ecological environment [11]. Danilenkova V studied the external and internal ecological risks in the ecological education environment of a school and the personality characteristics of students in the ecological education environment, such as pressure resistance, adaptability, motivation and ecological literacy [12]. Astrakhantseva I proposed an ecological classroom model based on the educational ecological environment, expanded students' cognitive and intellectual horizons, and improved students' learning ability and academic level [13]. Lu J analyzed the ecological environment of foreign language teaching from the perspective of educational ecology and put forward some suggestions for constructing an ecological environment in foreign language teaching. The experiment showed that students could develop their foreign language thinking ability better in a good foreign language teaching ecological environment [14]. The Development of education is also closely linked to the ecological environment in which it takes place. Coordinate the relationship between education and the ecological environment, understand the ecological law of education, and thus improve teaching and learning results.

To improve the effectiveness of English teaching and the sustained learning ability of students, this paper has briefly introduced the meaning and theoretical foundation of the educational ecological environment and analysed the deficiencies in actual English teaching activities. It also proposed an algorithm for the teaching of a sustainable development model and teaching effectiveness evaluation based on the ecological environment theory, and conducted experimental research on the sustainable development model of teaching.

2 Relevant Connotation and Theoretical Basis of Educational Ecological Environment

As shown in Figure 1, the relevant theoretical knowledge for this paper on the educational ecological environment is summarised below, including educational ecology and educational ecological environment.

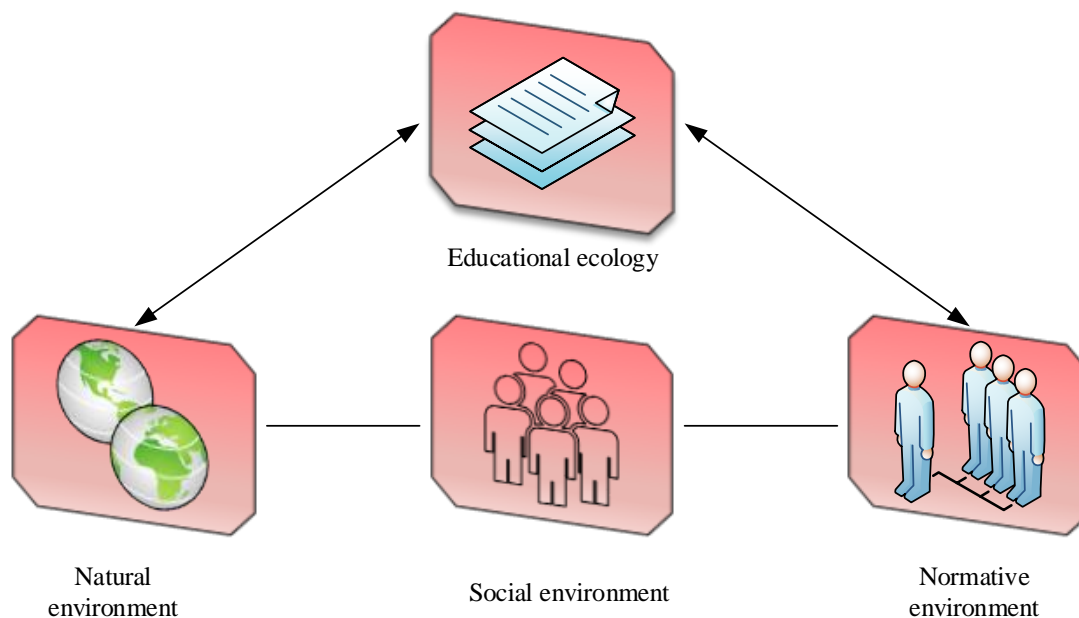


Figure 1: Related Connotations and Theoretical Foundations of Educational Ecological Environment

(1) Educational ecology

Educational ecology is a scientific system that applies the principles and mechanisms of ecology to the field of education to study the laws of educational development and predict trends and directions in educational development. Educational ecology does not only study ecological environmentalism and educational theory but also investigates their interaction and working methods through a combination of both [15]. Educational ecology is the application of ecological environments in education and is a cross-disciplinary field.

(2) Educational ecological environment

The educational ecological environment is a multi-dimensional space and diversified environmental system centered on education that restricts the generation, existence and development of education [16]. The ecological environment of education refers to the natural environment, the social environment, and the normative environment: The natural environment of education serves as the foundation for the entire educational ecosystem, and the social environment of education includes political conditions, economic conditions, school conditions, family conditions, etc.

(3) The theoretical basis of educational ecological environment

As shown in Figure 2, this paper first introduces the theoretical foundation of the educational ecological environment. The theoretical basis includes the development concept of quality education, the theoretical support for educational ecology, and the need for harmony among classroom relationships.

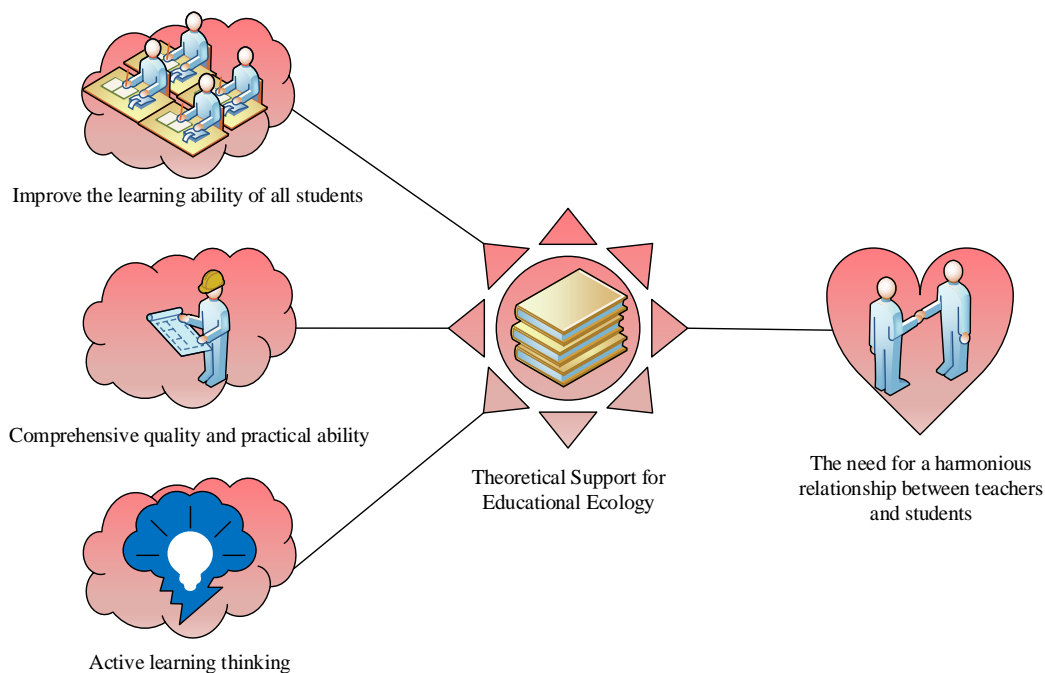


Figure 2: Theoretical basis for the educational ecological environment

1) Development Concept Based on Quality Education

Quality education has three contents: improve the learning ability and all-around quality of all students rather than focusing on enhancing the learning ability of individual students; cultivate and exercise students' all-round qualities and practical abilities, and the cultivation should not be limited to examination results; promote students' thinking of active learning so that they do not have to rely on teachers' guidance and can realize that learning is their own affair. Building a healthy school education ecological environment is to create the right conditions for high-quality education. Therefore, a school education ecological environment needs to be constructed.

2) Theoretical Foundation of Educational Ecology

The individual's development is the result of the combined effect of congenital heredity, growth environment and education. The construction of a healthy educational ecological environment is to promote the all-round development of individuals. The organisation of the school, its teaching philosophy and management strategies for teaching, as well as the resources available for teaching all have significantly affected the life and study habits of students [17].

3) The Demand for Classroom Harmony Relationships

The creation of a good school education ecological environment is conducive to fostering harmonious classroom relationships and helping to establish a positive emotional bond in the classroom, thus allowing both teachers and students to fully exercise their subjectivity in the process of education; as a result, students will increase their positive emotional investment in learning and improve both learning efficiency and ability.

3 Problems in English Teaching

Although there have been many achievements in terms of the scope of English-language teaching and the number of English-language teachers, some problems still exist in actual English-language teaching, as shown in Figure 3. These three are: the concept of backward

English teaching, problems in teaching mode, and an unscientific teaching evaluation system.

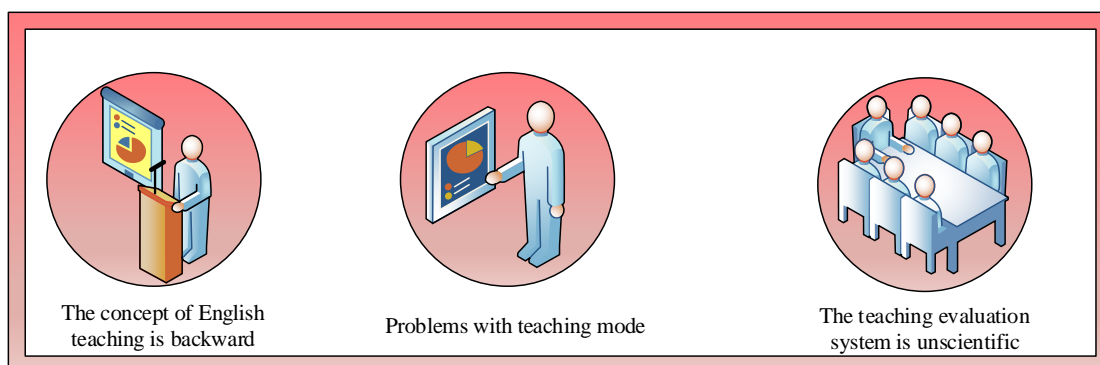


Figure 3: Problems in English Teaching

(1) The concept of English teaching falls behind

In English teaching, schools still only use the level of English learning in their students to judge teaching quality and focus on cultivating the students' theoretical knowledge. This only aims to foster students' mastery of theoretical knowledge, such as English vocabulary and grammar, and does not consider the practical application of English knowledge by students [18]. Students often need to spend a considerable amount of time learning English theoretical knowledge to achieve better academic results, and consequently, they do not have much time to gain a deeper understanding of English, leading some high-achieving students to have weak application abilities for English despite good academic performance.

(2) Problems in teaching mode

There is only one teaching mode, which is traditional teaching led by teachers; it does not promote active learning for students and fails to develop their English application ability [19]. Limited teaching resources in traditional teaching are not conducive to students' deep learning of English, and the efficiency of students' learning is also affected.

(3) Unscientific teaching evaluation system

The traditional teaching method's assessment system is also a single measure, which only considers students' grades as indicators of their learning outcomes and fails to motivate them in class or test whether they have gained knowledge and can apply that knowledge in practice [20]. This evaluation indicator reduces the students' desire to learn English.

4 Sustainable Development Path of English Teaching

Based on the background of the ecological environment, this paper presents a sustainability path for English teaching, as shown in Figure 4, which includes six elements: a "double main" teaching mode is constructed; advanced educational technology is applied to English teaching; the degree of emotional interaction between teachers and students is increased; the concept of lifelong learning is established; teaching and management are coordinated; and the efficiency of optimal allocation of educational resources is improved.

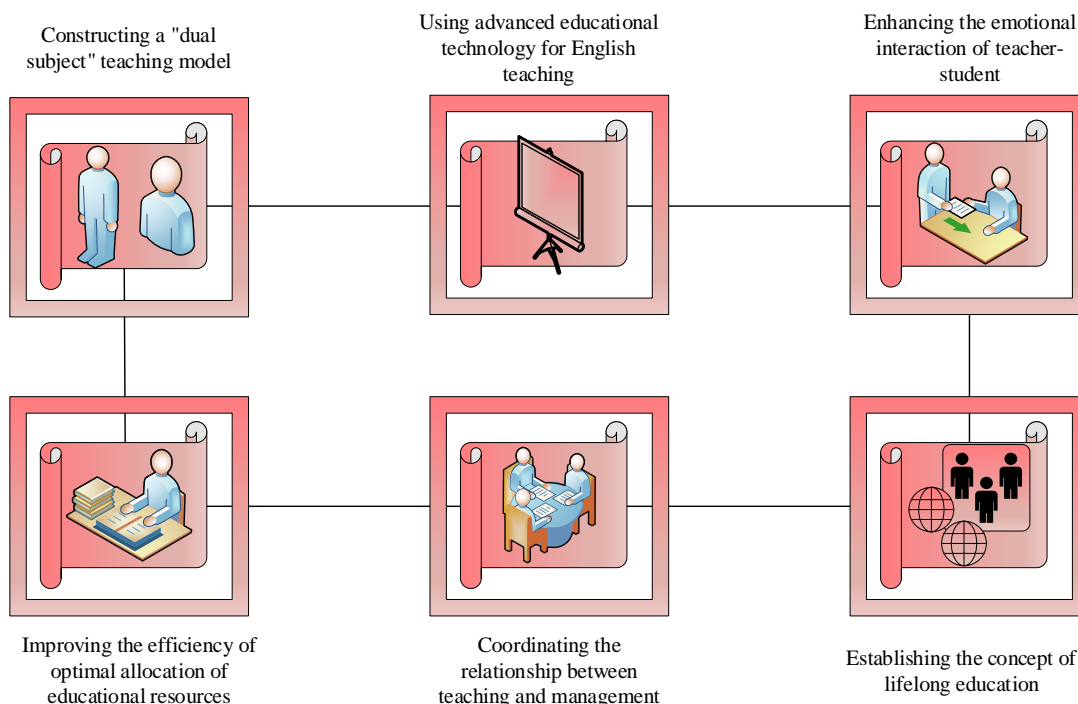


Figure 4: Path to Sustainability in English Teaching

(1) "Double main" teaching mode is constructed

The "double main" teaching model has teachers as the front-line instructors and students as the main learners. Teachers' roles will be modified in the classroom under the "double-centred" English teaching model. In the actual teaching of English in the classroom, one should pay more attention to the position of the students and use flexible teaching methods to boost their enthusiasm for learning.

(2) The advanced educational technology is used for English teaching

English teachers are using multimedia technology in their teaching to present rich images, sounds, videos and so on to grab students' attention; they are also employing educational technology to help students learn English better and improve their efficiency in acquiring English knowledge; additionally, they are using educational technology for feedback and evaluation in the English classroom. Teachers can record and analyze the students' classroom behaviour and homework completion to adjust the progress and plans of English teaching, and offer targeted guidance programs based on the students' particular learning circumstances.

(3) The degree of emotional interaction of teacher-student is enhanced

Although high-tech education can be used, a good relationship between teachers and students is also necessary to promote learning. Positive and effective emotional interaction between teachers and students can help to form a closer and more friendly teacher-student relationship; thus, students will be more likely to feel affection for their teachers and increase their emotional investment in English learning to enhance their mastery and application of English knowledge.

(4) The concept of lifelong education is established

Teachers should promote a spirit of lifelong learning and clarify the educational responsibilities of students to prevent the ideas and behaviors of seeking quick success and immediate rewards. Coordinate the connections between English teaching and English academic research more closely. Improve their teaching quality and strengthen their academic research ability, thereby enhancing teaching quality with high-quality research results.

(5) The relationship between teaching and management is coordinated

In determining the professional titles of teachers at higher education institutions, school administrators have focused more on the scientific research results achieved by teachers and paid less attention to the teachers' efforts in teaching work. School administrators should strengthen the place of English teaching activities in the overall construction of the school and link them to the all-around development of the school.

(6) The efficiency of optimal allocation of educational resources is improved

The interschool faculty is combined, and the educational resources are no longer dispersed and isolated but have converged and integrated. The school's ability to allocate resources and use educational resources has improved; thus, a sufficient variety of teaching materials and favorable resource environments have been provided for students' learning and good resources have been created to promote students' all-around development.

5 Application Algorithm in Teaching Effect Evaluation System

To examine the effectiveness of the sustainable development strategy for English teaching, this paper will use the analytic hierarchy process, European distance, entropy weighting method, combined weight, and Pearson product distance correlation coefficient to investigate the teaching effects of teachers.

The comparison matrix is constructed by using the analytic hierarchy process, and χ_{pq} represents the comparison result of factor p to factor q. The formula is as follows:

$$\chi_{pq} = \frac{1}{\chi_{qp}} \quad (1)$$

The table of comparison is as follows:

$$\alpha = (\chi_{pq})_{i \times j} = \begin{pmatrix} \chi_{11} & \cdots & \chi_{1j} \\ \cdots & \cdots & \cdots \\ \chi_{i1} & \cdots & \chi_{ij} \end{pmatrix} \quad (2)$$

The eigenvector of the largest characteristic root of the contrast matrix is as follows:

$$\alpha V = \kappa_{\max} V \quad (3)$$

The weight value of the single ranking of the corresponding factors in the feature vector is:

$$V_p = \frac{1}{j} \sum_{q=1}^j \frac{\chi_{pq}}{\sum_{c=1}^j \chi_{cq}} \quad (4)$$

The Consistency Evaluation Index of the comparison matrix is:

$$ci = \frac{\kappa_{\max} - j}{j - 1} \quad (5)$$

The Consistency Ratio of the comparison matrix is as follows:

$$cr = \frac{ci}{ri} \quad (6)$$

Minimax is used to reduce the size of the data. The Formula is:

$$\gamma_p = \frac{\chi_q - \min_{1 \leq q \leq j} \{\chi_q\}}{\max_{1 \leq q \leq j} \{\chi_q\} - \min_{p \leq q \leq j} \{\chi_q\}} \quad (7)$$

It is as follows:

$$\chi' = (\chi'_{pq})_{i \times j} = (\gamma_1, \gamma_2, \dots, \gamma_i)_{i \times j} \quad (8)$$

After data standardization, the proportion of element χ'_{pq} in χ' is as follows:

$$\lambda_{pq} = \frac{\chi'_{pq}}{\sum_{q=1}^j \chi'_{pq}} \quad (9)$$

The general form of the information entropy is as follows:

$$F_p = -\ln(j)^{-1} \sum_{p=1}^j \lambda_{pq} \ln \lambda_{pq} \quad (10)$$

Among them, the larger the value of F_p , the higher the disorder of information.

The calculation formula of each evaluation index weight is as follows:

$$\omega_p = \frac{1 - F_p}{\sum_{p=1}^c (1 - F_p)} \quad (11)$$

The evaluation index of the j-th evaluation object is as follows:

$$\sigma_q = \sum_{p=1}^c \omega_p \chi'_{pq} \quad (12)$$

Euclidean distance is used to determine how much each evaluation index affects the evaluation object, and the formula is:

$$\chi'_{q0} = \frac{1}{j} \sum_{p=1}^c \omega_p \chi'_{pq} \quad (13)$$

The evaluation index is weighted according to the entropy value weighting method, and the comprehensive score of the evaluation object is as follows:

$$\hat{v}_p = (v_{p1}, v_{p2}, \dots, v_{pj}) \quad (14)$$

The total score is unitless, and the formula is as follows:

$$v'_{pq} = \frac{v_{pq}}{\sum_{i=1}^j v_{pq}} \quad (15)$$

Euclidean distance is employed to compute the relative change distance of the evaluation object:

$$e_p = \sum_{q=1}^j |v'_{pq} - v'_{0q}|^2 \quad (16)$$

An average weight is adopted for the evaluation indicators.

$$cw = e_p V_p \quad (17)$$

The correlation between two random variables can be calculated as the correlation coefficient of the product distance:

$$\mu = corr(\chi_{pj}, \chi_{pi}) = \frac{cov(\chi_{pj}, \chi_{pi})}{\sqrt{var(\chi_{pj})} \sqrt{var(\chi_{pi})}} \quad (18)$$

The linear weighted sum method is employed to compute the evaluation index of the p-th evaluation object as follows:

$$\beta_p = \sum_{q=1}^j |\mu_{pq}| cw_q \quad (19)$$

6 Experimental Investigation and Evaluation on the Sustainable Development Path of English Teaching

Select two schools, and from each school, choose 50 students. The academic levels of these students are relatively close, so they will be distributed among the two schools after the order is adjusted. Among them, 50 students from one school have English learning activities based on the path of sustainable development for English teaching. This school is called School S, and this teaching mode is referred to as the sustainable development teaching mode; the 50 students at a school engage in English learning activities according to traditional teaching methods, and this school is called School A. Five areas of students' emotional participation in English learning are taken into account: students' learning efficiency, students' academic levels, students' practical skills, and students' satisfaction; over a six-week teaching period, the impact of two different teaching models on these five factors for students in two schools will be investigated.

(1) The students' emotional involvement level in English learning

The extent to which students are emotionally engaged in learning will directly affect how

well they learn. Observe and record the emotional involvement level of the students in English learning. The index of emotional involvement is in the range of 1-100, and the corresponding results are shown in Figure 5.

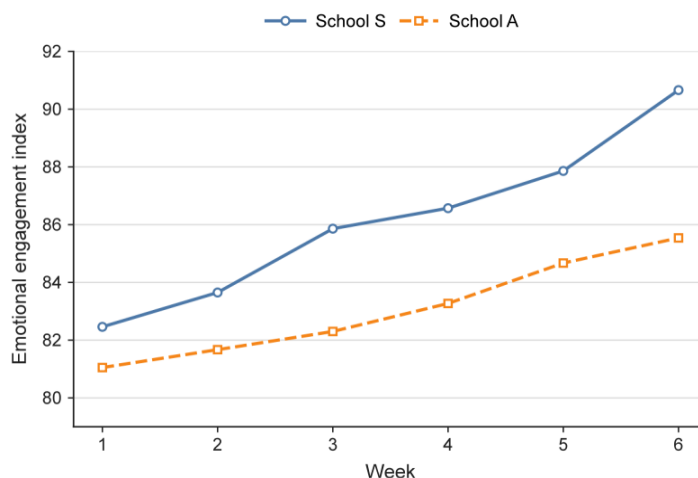


Figure 5: Students' Level of Emotional Engagement in English Learning

As shown in Figure 5, generally speaking, the level of emotional involvement of students in learning at School S and School A is increasing gradually. The students in the two schools have been more eager to study under the experiment. Based on the above specific data, the level of students' emotional involvement in learning in the first week of School S was 82.46, and by the sixth week, this figure had increased to 90.66; that is to say, there was a difference of 8.2 points. The emotional input level for students at School A in the first week was 81.05, and it rose to 85.54 by the sixth week. The students' learning emotional input level in the sixth week of School A is 4.49 higher than that in the first week. The mean of the students' learning emotional input at School S is 86.18, and the mean at School A is 83.08. The mean learning emotion input level of the students at School S is 3.1 points higher than that at School A, and the rate of increase is 3.73 per cent.

(2) English learning efficiency of students

Track the specific learning of students and, using an emotion recognition algorithm based on expression and posture, questionnaire surveys at School S and School A, obtain indicators of students' English learning efficiency. Figure 6 is as follows:

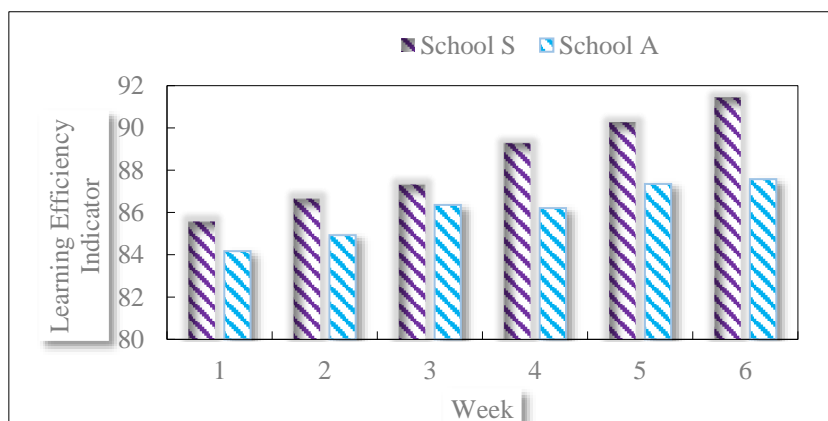


Figure 6: English Learning Efficiency of Students

As shown in Figure 6, in the sixth week, the English learning efficiency index of the students in School S was 91.43 and that in School A was 87.58. The two are 3.85 apart. Based on the final index of students' English learning efficiency, a sustainable development teaching model can be used to boost students' learning efficiency. The gap in the first and sixth weeks of students' English learning efficiency indicators is 5.86 in School S and 3.14 in School A. The average English learning efficiency index for students in School S is 88.42, and for School A, it is 86.1. The average index of students' English learning efficiency in School S is 2.69 per cent higher than that in School A.

(3) Students' English learning level

Every week, an all-around test is conducted on the English-learning abilities of students at School S and School A to check their word memory, grammar usage, comprehension of English knowledge, etc. The test results are as follows: Table 1.

Table 1: Students' English Academic Level

	School S	School A
1	81.62	79.27
2	82.45	81.13
3	86.27	82.64
4	88.29	84.39
5	90.7	85.32
6	92.53	86.54

As shown in Table 1, students' English-learning levels in the first week are 2.35 points higher at School S than at School A. It can be seen from the above that the sustainable development teaching mode has several advantages over the traditional teaching mode in enhancing students' abilities, and these advantages are more pronounced. By the end of the second week, the English-learning levels of the students at School A and School S will be very close. However, in the sixth week, there is a considerable difference in the English learning level of students at School S and at School A. The mean weekly English learning levels for students in School S and School A are 86.98 and 83.22, respectively, and the difference is 3.76. The average weekly English learning level of students at School S is 4.52% higher than that at School A, and it can be seen that the continuous development path of English teaching based on the theory of educational ecological environment is effective.

(4) Students' practical ability

Observe students' application ability of English knowledge in practice and organise English communication practice activities to record their performance. The particular contents are shown in Figure 7.

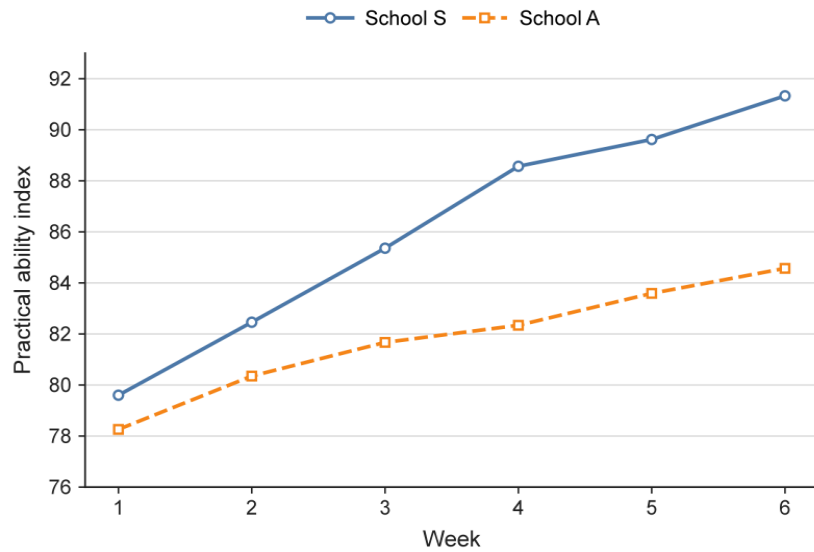


Figure 7: Students' Practical Skills

As shown in Figure 7, the students' practice ability in the sixth week at School S and School A were 91.33 and 84.57, respectively. The students' practice ability in the sixth week of School S is 7.99 per cent higher than that at School A. The mean of students' English learning practice frequency in School S and School A per week are 86.16 and 81.8, respectively; this is a difference of 4.36. The mean English learning practice ability of the students in School S each week is 5.33 per cent higher than that in School A.

(5) Student satisfaction

Through the questionnaire, we have learned about the students' satisfaction with the two modes of teaching. Figure 8 shows the student satisfaction indicators of School S and School A.

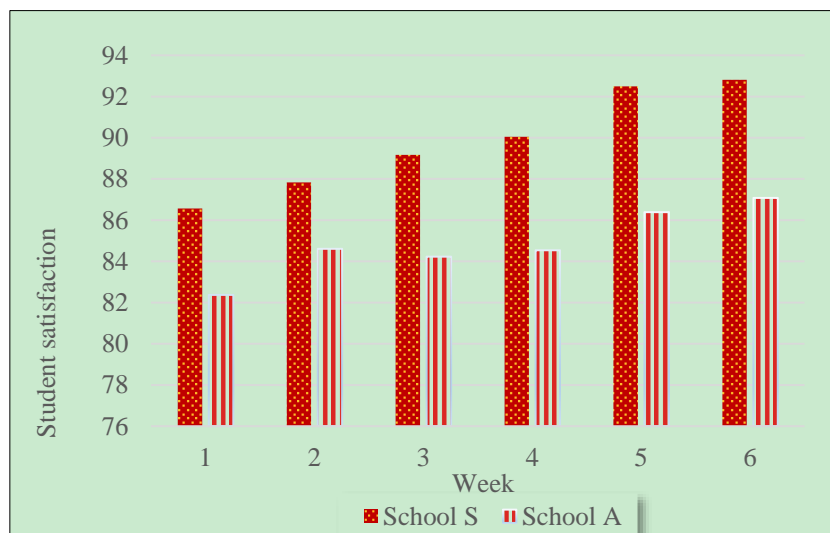


Figure 8: Student Satisfaction with the Two Teaching Models

As shown in Figure 8, the mean satisfaction of students at School S and School A are 89.82 and 84.87, respectively, with a difference of 4.95. The mean satisfaction levels of the two schools are 5.83% lower at School A. It can be seen from the above that the students have shown more interest in the new way of teaching than in the old.

7 Conclusions

Based on the theory of educational ecological environment and problems in English teaching, this paper proposed a teaching model for sustainable development, and then conducted research and experiments on both the traditional teaching model and the teaching model of sustainable development. Based on the above experimental results, it can be seen that the mode of teaching for sustainable development has improved students' emotional investment in English learning, their ability to apply English knowledge in practice, and both the efficiency of their English learning and their English learning ability and learning experience.

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About the Author

Shuling Yang, born in 1979 and originally from Siping, Jilin, is an associate professor at Jilin Normal University with a master's degree. She obtained both her Master's and Bachelor's degrees from Jilin Normal University. Her main research interests include business English, cross-border e-commerce, and innovation and entrepreneurship education.

Haiyan Peng, born in 1985, female, of Dong ethnicity, from Huaihua, Hunan Province. She has a Master's degree and is a teacher. She is studying English teaching.

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