



## **Ecological Construction and Sustainable Teaching Exploration of Multimedia Intelligent Information Technology in English Classroom**

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**SUMMARY:** *As the most frequently used language in the world, English classroom teaching is extremely important. However, the traditional English classroom teaching method is single, which leads to the poor teaching effect of the traditional English classroom. The ecological construction of English classroom is to regard everything related to English classroom teaching as a whole, and develop each English teaching in a balanced way, which is a sustainable teaching plan. The integration of multimedia information technology into ecological English classroom instruction is able to expand the range of English classroom teaching, therefore it lets students comprehend English teaching materials with more high efficiency. When we carry out comparison between ecological English classroom teaching which uses multimedia intelligent information technology and traditional English classroom teaching, the results show that in primary school English courses, the average teaching effect of ecological English classroom teaching depending on multimedia intelligent information technology and traditional English classroom teaching is 79.6% and 72.4% separately. In middle school English courses, the average teaching effect of ecological English classroom teaching that is based on multimedia intelligent information technology and traditional English classroom teaching is 83.4% and 78% respectively. As the consequence, ecological English classroom teaching which is supported by multimedia intelligent information technology thus can significantly promote the efficiency of English classroom teaching in primary and secondary schools.*

**KEYWORDS:** *Sustainable Teaching; Ecological Construction; English Class; Multimedia Intelligent Information Technology*

## **1 Introduction**

With English serving as the primary language of international communication, the level of economic and cultural contacts around the world is continuously increasing. China's English education has been popularized from the initial university elective to junior high school English education. Now China's English education has officially opened to primary schools and even kindergartens. English education is a foreign language teaching for China. English classroom teaching focuses on enlightenment, and teaching methods should be novel, interesting and attractive. Nevertheless, inside the traditional English teaching room environment, the mutual action between teachers and students is comparatively inactive, and spoken English ability still stays in the state of insufficient use. Traditional English teaching

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<https://doi.org/10.65102/is2026503>

mainly depends on teachers' speaking explanations and students' passive receiving of knowledge. Through the passing of time, English teaching has gradually become a tool for preparing examinations. The pupils every day are carrying out question-brushing, and they obtain very little on the aspect of English skills besides reading and writing. For the promotion of the English classroom teaching environment, the theory of sustained development is brought into English education. Through the coordination of each component of English classroom teaching, for example teaching content, teaching objectives, teaching methods, and the teaching environment, an ecological English classroom is built. Furthermore, in the time of multimedia intelligent information technology development, putting multimedia technology into the ecological English classroom not only simplifies English teaching but also promotes the efficiency and quality of English teaching. Therefore, this paper possesses comparatively great research significance.

The traditional English classroom teaching process does not pay attention to the balanced development of English teaching. Relevant researchers have carried out ecological construction of English classrooms and carried out sustainable English classroom teaching. Liu B's research showed that the education method of college English classroom focuses on the development of college students' English communication ability, so that college students can develop comprehensively in English learning [1]. By comparing sustainable English classroom education with traditional English classroom teaching, Christine F's research showed that sustainable English teaching can effectively improve students' interest in learning English [2]. Puspita N improved students' English classroom learning efficiency by balancing the process of English classroom teaching and learning [3]. Creel T ecologically constructed English classroom elements such as English teachers, students, and teaching methods to improve students' comprehensive ability in English learning [4]. The construction of an ecological English classroom can improve the learning efficiency of students, but it lacks intelligent teaching methods.

Multimedia intelligent information technology is gradually being implemented in education as a result of the ongoing development of Internet technology. Many academics have blended the ecological design of English classrooms with multimedia intelligent information technology. Zou S's research pointed out that the combination of multimedia intelligent information technology and foreign language classroom teaching can provide a superior environment for students to learn foreign languages [5]. Liu L used multimedia technology to intelligently project the courseware of English classroom, which can help students learn more English knowledge [6]. Diao L applied multimedia intelligent information technology to college English classroom, and improved students' understanding of English classroom by intelligently translating the language in English classroom [7]. Li X's research pointed out that schools can use multimedia technology to use slides in the classroom to carry out English classroom teaching, and improve the construction of the English ecological environment through the presentation of multiple elements [8]. Multimedia intelligent information technology can expand the knowledge of students' learning and help students learn English more effectively, but there is a lack of comparative analysis with traditional English classroom teaching.

Multimedia intelligent information technology can provide students with an intelligent learning environment and expand the knowledge that students cannot learn in books. Through video, animation and sound to make the English classroom realistic, teachers, students and multimedia technology can be integrated to realize the ecologicalization of the English classroom [9]. This paper compared and analyzed the English classroom ecological teaching of multimedia intelligent information technology and traditional English classroom teaching, and concluded that the ecologically constructed sustainable English education can effectively

improve the degree of teacher-student interaction.

### 1.1 Method of Ecological Construction of English Classroom

English is a very important subject in China. Students need to learn English from primary school to middle school to university. The most effective way of teaching English is classroom teaching. However, the effect of traditional classroom education is not good. This is due to the single educational method of traditional English classroom education, which makes it difficult for students to improve their English proficiency. The teaching of English in the classroom must be improved overall, and its effectiveness must be increased by creating a long-term lesson plan and incorporating smart technology [10, 11]. Figure 1 depicts the structural model of intelligent English classroom instruction.

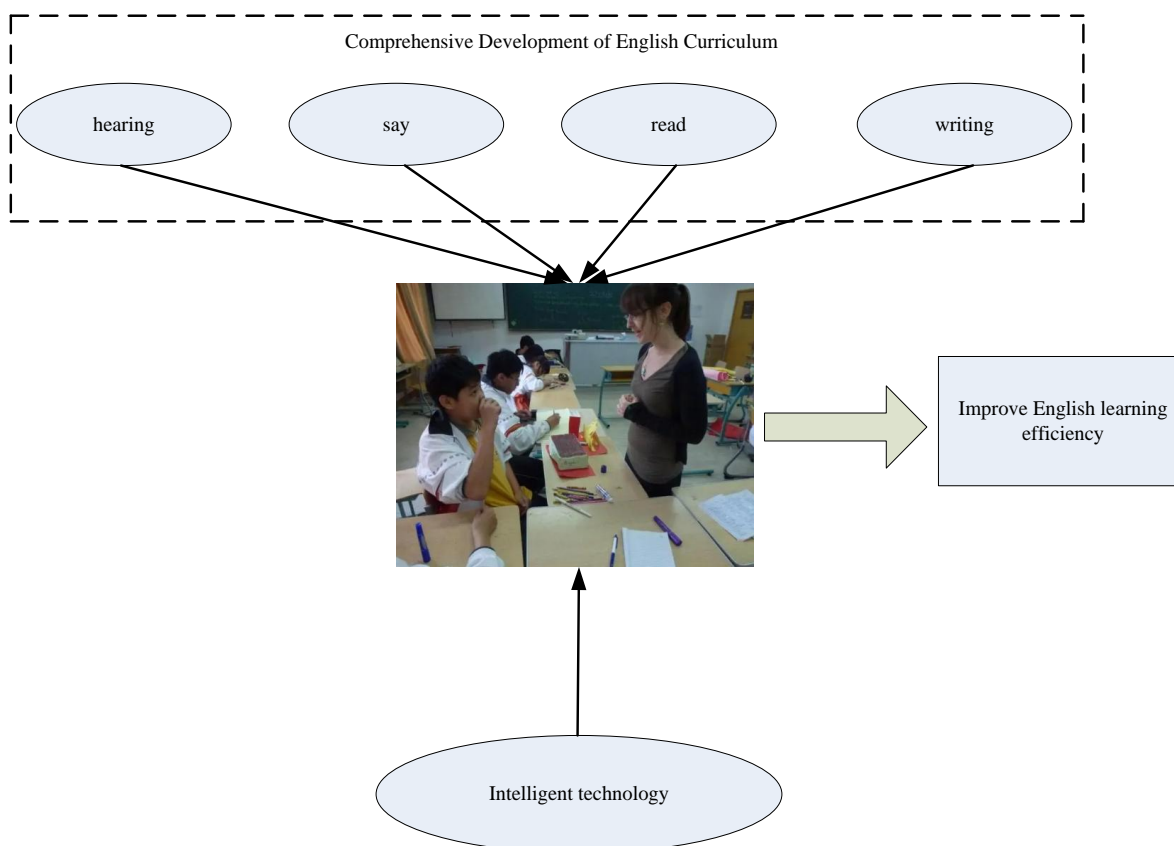


Figure 1: Structural model diagram of intelligent English classroom teaching

Figure 1 gives a analysis about the structure model for intelligent English classroom teaching guidance. By making use of intelligent technology, English classroom teaching uses multimedia and other technology methods to assist English education work. Intelligent English teaching realizes the comprehensive development of English curricula through ecological building, hence promoting the study efficiency of learners in English classrooms. The ecosystem building in English classroom teaching lets the balanced development among various English teaching fields achieve balance and thus promotes the progress of English education. Furthermore, the usage of multi-media to assist English teaching promotes the achievement, mutual action, and manifestation in English classrooms [12, 13].

## 1.2 Ecological Construction of English Classroom

Everything in the world is regarded as a stable, coordinated and unified biological community composed of different parts, which is a summary of the natural ecology. Ecological construction is a sustainable development method, which is widely used in the fields of economy, environmental protection and medical treatment. The unbalanced development of English classroom education requires ecological construction of English classroom education [14].

Teaching philosophy, teaching technology, teaching mode, professional ability, students' learning interest, ability, learning method, teacher-student interaction, teaching activities, etc. are all components of the English classroom ecosystem. In this system, the relationships among teachers, classroom learning environment and students are interdependent and mutually influenced [15, 16]. If the composition or supervision of trace elements has any change, therefore the whole ecological micro-environment shall be influenced. This thing, in turn, will produce an influence on the effect degree and quality of English teaching work. Therefore, the ecological construction of the English classroom has very great importance. The progress of the ecological construction of the English classroom is showed in Figure 2.

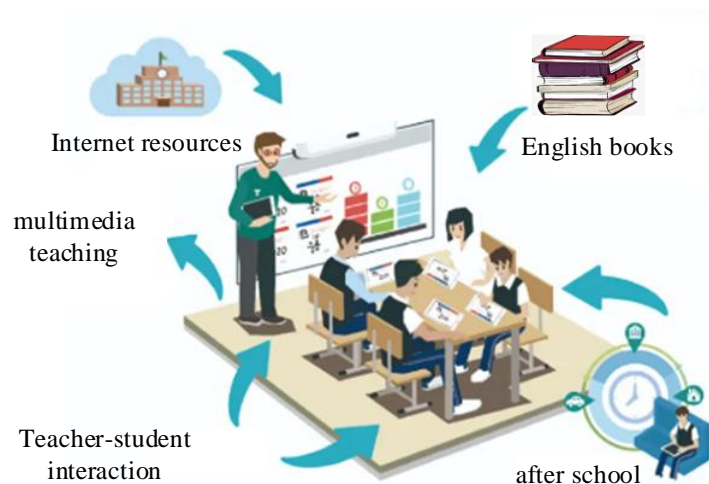


Figure 2: Process map of ecological construction of English classroom

In Figure 2, the ecological construction process of English classroom is described, which integrates students, teachers and all English classroom resources into a whole.

The ecological construction of English classroom has the following teaching characteristics:

The balanced development of English teaching in the ecological classroom: the stability of the ecological system balance, the coordination and unity of many components of the system, and the connection with the outside world are all guaranteed by the English ecological classroom system. English teachers, students, textbooks, contemporary technology are all key ecological components. Among them, teachers are the most important leading factors, and students are the center of gravity of the system. Everything is for students. Teachers and students, teaching components and contemporary technology are the ecological components that interact in the English ecological classroom system [17, 18].

Sustainable development of ecological classroom: the ecological classroom system needs long-term, effective and stable development. Students should act as the main driving force for the continuous development of English classroom teaching ecological system. The composing parts inside this ecological system are got together in coordination, combined, and on each

side can fit well with each other. This therefore guarantees the stable advancement of the whole system and the achievement of the objectives of English classroom teaching.

### 1.3 Multimedia Intelligent Information Technology

Multimedia technology has been heavily used into the teaching of English due to the quick development of information technology. More and more teachers combine it with traditional English classroom teaching methods and achieve good results. Multimedia teaching uses its unique advantages to make English classroom teaching more vivid, vivid and interesting [19].

Multimedia intelligent information technology has been employed extensively in English instruction due to the quick growth of information technology. Multimedia intelligent information technology has been successfully used by more and more teachers in English classroom teaching.

Multimedia consists of many different sounds, images, animations and other aspects. It also combines visual and auditory elements to allow students to enjoy learning English in the classroom. Multimedia can immerse them as if entering a real environment, and bring static or dynamic vision and scenes into the eyes and ears of students [20]. The combination of multimedia intelligent information technology and English classroom is shown in Figure 3.

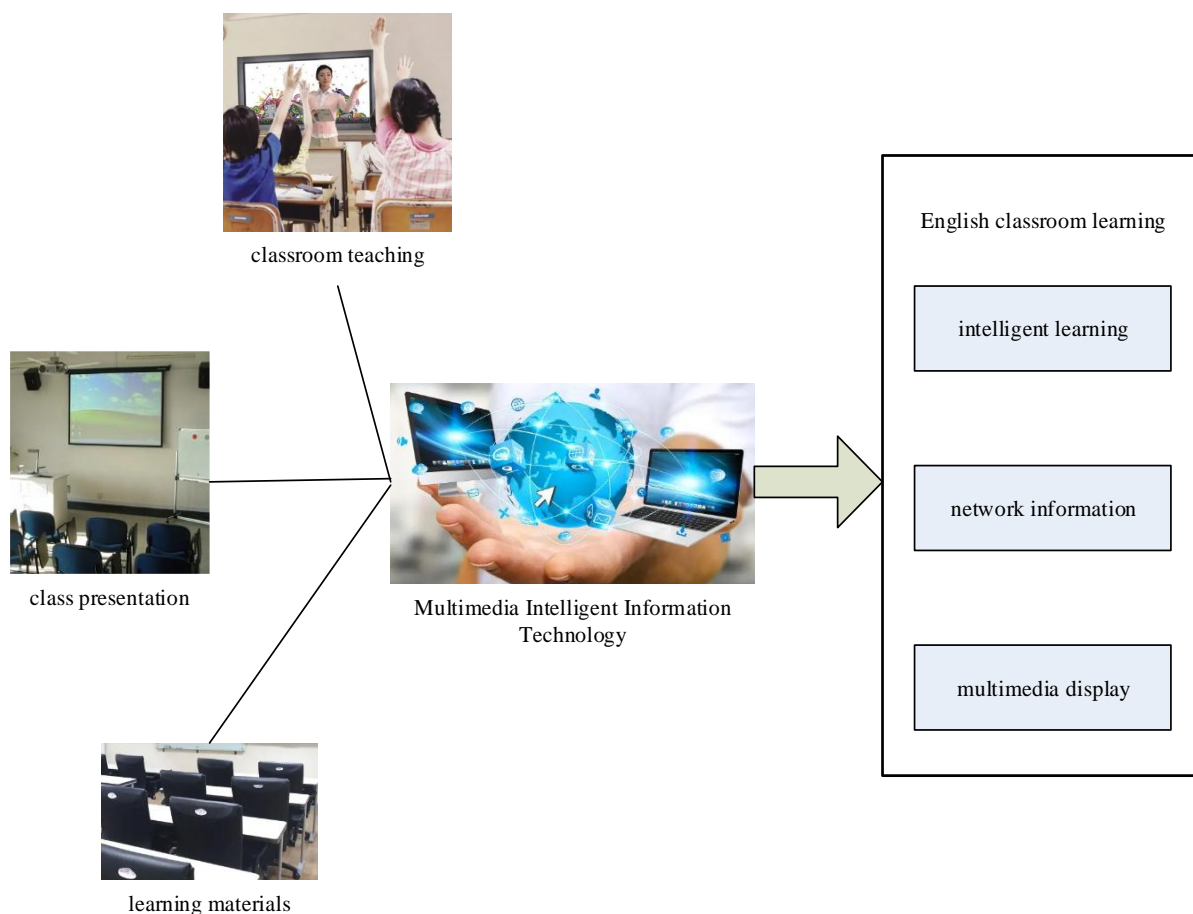


Figure 3: The combination of multimedia intelligent information technology and English classroom

In Figure 3, the multimedia intelligent information technology is applied to the English classroom, which can provide multimedia classroom teaching, multimedia demonstration, and downloading of network resources. This makes the teaching of English classrooms more

intelligent and diversified, and improves the efficiency of English classroom teaching.

Multimedia-assisted teaching has the incomparable advantages of traditional teaching methods, so it has been used more and more in English teaching. However, if the multimedia teaching is used excessively and excessively, it would overwhelm the guest and go against the purpose of multimedia "assistance" teaching. This would make students in the classroom as if they are looking at flowers, resulting in classroom teaching mere formality. It can't be seen from the outside to the inside, let alone really give full play to the initiative of students [21, 22].

With its incomparable advantages over traditional teaching techniques, multimedia-assisted learning is becoming more and more popular in English teaching. However, if multimedia teaching is used excessively, students would be overwhelmed, which would defeat the goal of multimedia "assisted" teaching, and make classroom teaching only a form.

### 1.4 Fuzzy Analytic Hierarchy Process

Fuzzy AHP (Analytic Hierarchy Process) is the analysis of the system by studying the influencing factors, and it is a combination of qualitative and quantitative analysis. It has a wide range of applications in the fields of education, medical care and sports, and can effectively explore the factors that affect the ecological construction of English classrooms and sustainable teaching [23]. Through the analytic hierarchy process, the indicators that affect English classroom teaching are analyzed, and then the relevant indicators are weighed by fuzzy analysis. The structure of fuzzy AHP is shown in Figure 4.

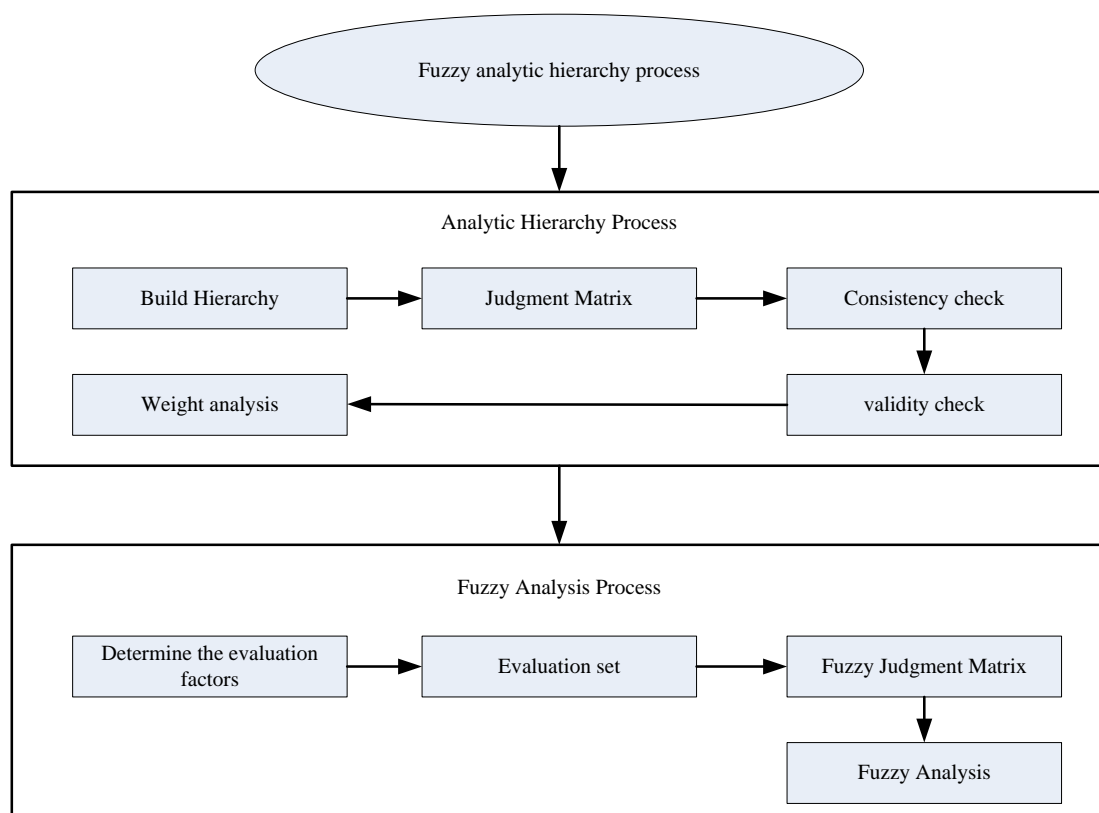


Figure 4: Fuzzy Analytic Hierarchy Structure Diagram

In Figure 4, the research process of AHP is described. The ecological construction and

sustainable teaching of English classrooms need to carry out weight analysis through judgment matrix, and then use fuzzy analysis to study the impact of indicators on English classroom teaching.

If there are  $n$  indicators that affect the ecological construction and sustainable teaching of English classrooms, the indicator set can be established as  $A = \{a_1, a_2, \dots, a_n\}$ . Among them, the ratio of the influence of any two indicators  $a_i$  and  $a_j$  in the  $A$  set on English classroom teaching can be expressed as  $a_{ij}$ , then the influence ratio of these two indicators in turn can be expressed as  $a_{ji}$ .

Therefore, there is a relationship as shown in Formula (1):

$$a_{ij} = \frac{1}{a_{ji}} \tag{1}$$

The judgment matrix can be expressed as:

$$H = (a_{ij})_{n \times n} \tag{2}$$

The judgment matrix is checked for consistency:

$$T = \frac{t_{\max} - n}{n - 1} \tag{3}$$

In Formula (3),  $t_{\max}$  represents the largest eigenvalue of the judgment matrix. The consistency parameter corresponding to the judgment matrix is analyzed:

$$U = \frac{t'_{\max} - n}{n - 1} \tag{4}$$

In Formula (4),  $t'_{\max}$  represents the average maximum eigenvalue of the judgment matrix  $n \times n$ .

Therefore, the consistency ratio can be expressed as:

$$R = \frac{T}{U} \tag{5}$$

The consistency ratio of the judgment matrix is the precondition for calculating the index weight. When  $R < 0.1$ , the index weight can be calculated by using this matrix.

The arithmetic average processing is performed on each index of the column vector of the judgment matrix, and the processing process is as follows:

$$w_i = \frac{a_{i1} + a_{i2} + \dots + a_{in}}{n} \tag{6}$$

In Formula (6), the value range of  $i$  is  $\{1, 2, \dots, n\}$ .

The set of indicators that have an impact on the ecological construction of English

classrooms is determined as:

$$A = \{a_1, a_2, \dots, a_n\} \quad (7)$$

The index is classified by fuzzy analysis. Four levels are set for the ecological construction level of English classroom, which are excellent, good, medium and poor, then the judgment level is expressed as:

$$V = \{v_1, v_2, v_3, v_4\} \quad (8)$$

The weight of the indicators is analyzed, and the relationship is as follows:

$$\sum_{i=1}^n w_i = 1 \quad (9)$$

By performing membership analysis on the indicators, it can be obtained:

$$m_{ij} = \begin{cases} 1, (i = j) \\ 1 - k |b_i - b_j|, (i \neq j) \end{cases} \quad (10)$$

In Formula (11), k represents a constant, and  $|b_i - b_j|$  represents the difference between the scores of the two indicators.

The fuzzy matrix is constructed by using the membership degree of the index as:

$$M = \begin{pmatrix} m_{11} & m_{12} & m_{13} & m_{14} \\ m_{21} & m_{22} & m_{23} & m_{24} \\ m_{31} & m_{32} & m_{33} & m_{34} \\ m_{41} & m_{42} & m_{43} & m_{44} \end{pmatrix} \quad (11)$$

If the weight of each indicator is expressed as W, then there are:

$$W = \{w_1, w_2, \dots, w_n\} \quad (12)$$

Therefore, the results of ecological construction and sustainable teaching of English classrooms using fuzzy analysis are expressed as:

$$Y = W \cdot M \quad (13)$$

The results of fuzzy analysis are expanded and expressed, and it can be obtained:

$$Y = (y_1, y_2, \dots, y_n) \quad (14)$$

The fuzzy analytic hierarchy process can determine the factors that affect the ecological construction and sustainable teaching of English classrooms, so as to analyze the impact of multimedia intelligent information technology on the ecological construction of English classrooms [24].

## 2 Experiment of Ecological Construction of English Classroom

### 2.1 Data Sources of English Classroom

English classroom is the main way for students to learn English, but the overall effect of English classroom education is not very good. This paper explored the main factors affecting English classroom education, and conducted a questionnaire survey on 100 English teachers and 400 students. The results of the questionnaire survey are shown in Table 1.

*Table 1: Questionnaire survey results that affect English classroom education*

Serial number	Index	Number of people (person)	Percentage
1	Teaching efficiency	90	18%
2	Student academic record	100	20%
3	Student learning initiative	80	16%
4	The Balance of English Classroom Teaching	70	14%
5	Knowledge of English Teaching	70	14%
6	Teacher-student interaction	90	18%

In Table 1, a total of 6 indicators were counted. Among them, the indicator with the largest number was the student academic achievement indicator, which accounted for 20%. The proportions of the six indicators in Table 1 were not very different, and the six indicators were analyzed by fuzzy hierarchy process.

The fuzzy analytic hierarchy process was used to analyze the impact of ecological construction of English classrooms. First, the hierarchical structure was constructed, and the weight relationship of the criterion layer was analyzed. The hierarchical structure is shown in Table 2.

*Table 2: Hierarchical structure of ecological construction of English classroom*

Target layer	Criterion layer	Criterion layer weights	Indicator layer
Ecological Construction of English Classroom	Teaching efficiency	26%	Teaching efficiency
	Student learning	24%	Student academic record
			Student learning initiative
	Classroom teaching	25%	The Balance of English Classroom Teaching
			Knowledge of English Teaching
Teacher-student relationship	25%	Teacher-student interaction	

In Table 2, the hierarchical structure of the ecological construction of the English classroom and the index weight of the criterion layer were analyzed, and the highest weight was the teaching efficiency.

The relative weight of each index was determined by fuzzy AHP, and the weight analysis was carried out by using the judgment matrix. The weight of each indicator is shown in Table 3.

*Table 3: Weights of ecological construction indicators in English classrooms*

Serial number	Index	Weights
1	Teaching efficiency	26%
2	Student academic record	21%
3	Student learning initiative	3%
4	The Balance of English Classroom Teaching	21%
5	Knowledge of English Teaching	4%
6	Teacher-student interaction	25%

In Table 3, the weights of 6 indicators were analyzed. Among them, the weight of teaching efficiency index was the highest at 26%, while the weight of students' initiative in learning and the knowledge of English teaching were relatively small, which were 3% and 4% respectively.

Therefore, the four indicators of teaching efficiency, students' academic performance, the balance of English classroom teaching, and the degree of teacher-student interaction were used as indicators to evaluate the ecological construction of English classrooms and the effect of sustainable teaching.

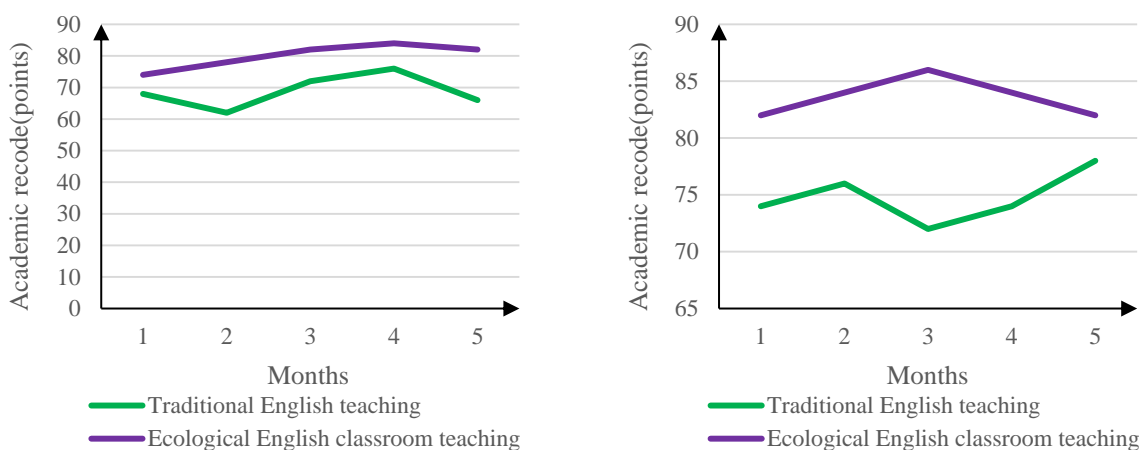
## **2.2 Experimental Design of the English Classroom**

This research regards the English classroom as an ecological teaching frame and uses multimedia intelligent information technology to promote teaching efficiency. A comparison has been done by us between its influence and the influence of traditional English instruction in 10 elementary schools and 20 secondary schools, in which half of these schools have adopted the traditional method. This experiment has spanned a total of five months, and classroom teaching data were collected by us on each month's basis.

## **3 Result of Ecological Construction of English Classroom**

### **3.1 Student Academic Achievement**

The purpose of ecological construction of English classroom is to improve the effect of students' English learning, and the index that reflects the effect of English learning is students' learning performance. Primary and secondary schools are the main subjects of English learning in the classroom. The two types of students have different learning content and age, and the learning effect of classroom English is different. The ecological English classroom teaching and traditional English teaching based on multimedia intelligent information technology were compared and analyzed, and the comparison results of students' academic performance are shown in Figure 5.



(a) Academic performance of primary school students

(b) Academic performance of secondary school students

Figure 5: Results of the comparison of students' academic performance

Figure 5(a) depicts the comparison of English learning performance of primary school students under two kinds of English classroom teaching. Among them, in the second month of traditional English classroom teaching, the English score of primary school students reached a minimum of 62 points; in the fourth month, the English score reached a maximum of 76 points. The English grades of primary school students under the ecological English classroom teaching based on multimedia intelligent information technology were generally better than those of traditional English teaching methods; in the fourth month, the highest score was 84, and the average English learning score of primary school students was 80. Figure 5(b) analyzes the comparison of English learning performance of middle school students under two kinds of English classroom teaching. Among them, middle school students in the third month of traditional English classroom teaching had the worst English learning performance, with a score of 72 in the third month. The English learning performance of middle school students under the ecological English classroom teaching based on multimedia intelligent information technology reached the highest score of 86 in the third month, and the lowest in the first month and the fifth month. Therefore, students in elementary and middle schools can get better academic results if multimedia information technology is applied to the ecological design of English classrooms.

### 3.2 Degree of Interaction Between Teachers and Students

The contact between teachers and students can strengthen this bond and advance the teaching of English in the classroom. This paper compared the teacher-student interaction between ecological English classroom teaching based on multimedia intelligent information technology and traditional English classroom teaching. In order to effectively analyze the comparison results of the teacher-student interaction between the two English classroom teaching methods, the experiment was set up for a 5-month comparison, and the interaction between teachers and students was counted every other month. The comparison results of teacher-student interaction degree of two kinds of English classroom teaching are shown in Figure 6.

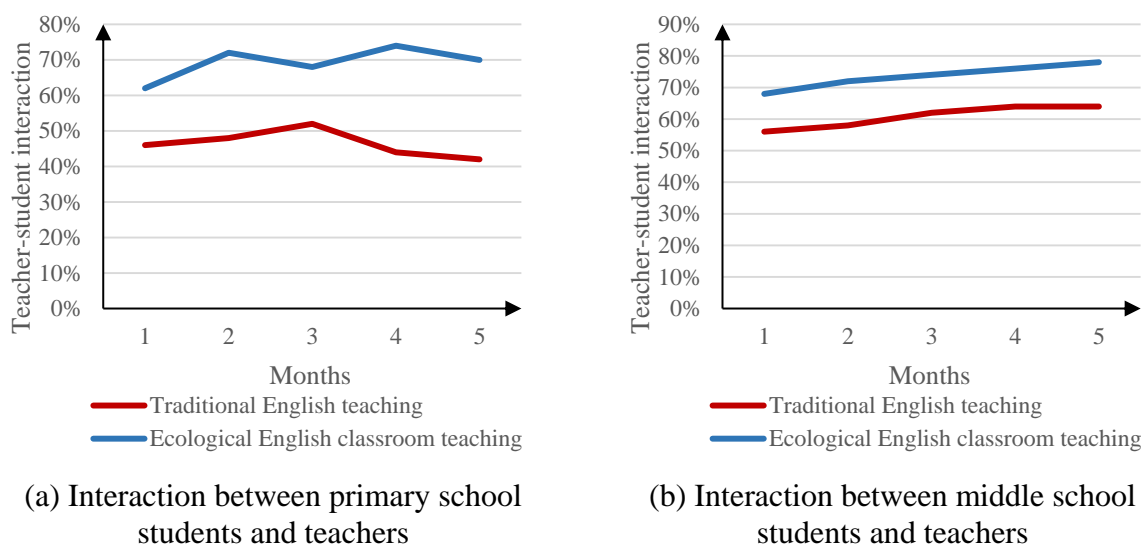
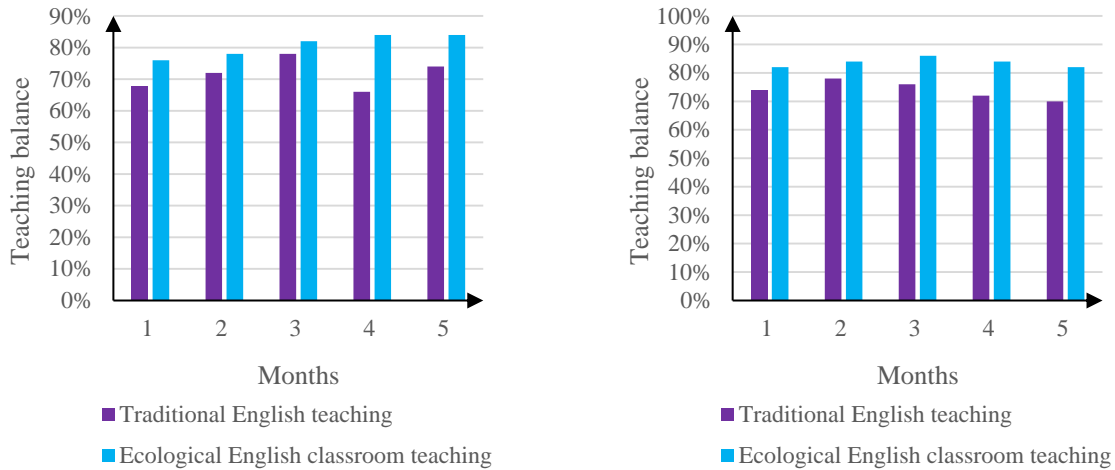


Figure 6: Comparison of the degree of interaction between teachers and students

Figure 6 shows that in the ecological English classroom which is based on multimedia, there exists a more sturdy interaction between teacher and students. In the primary schools, the proportion that traditional teaching has first gone up and then gone down. It reached a highest point of 52% at the third month and after that it fell to 42% at the fifth month. By comparison, the ecological model has obtained a rate that is 74% in the fourth month. In the secondary schools, the degree of traditional interaction rose from 56 percent to 64 percent. At the same time, in the five-month time length, the interaction rate of the ecological model has the increase from 68% to 78%.

### 3.3 Balance of English Classroom Teaching

English language skills including speaking, listening, reading, and writing are also taught in educational settings in addition to basic question-and-answer instruction. The goal of English classroom instruction is to develop pupils on all levels, and maintaining balance in this process is crucial. Since the English teaching of primary school students and the English teaching of middle school students are different, the teaching balance of the two English classroom teaching methods should be compared differently for primary school students and middle school students. Figure 7 shows the comparison results of the teaching balance between ecological English classroom teaching and traditional English classroom teaching based on multimedia intelligent information technology.



(a) The balance of English teaching in primary schools

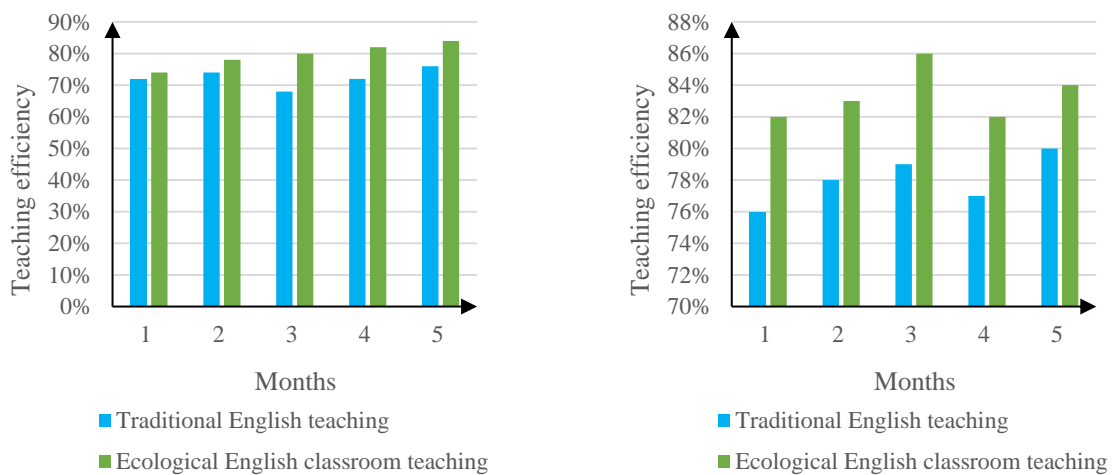
(b) The balance of English teaching in middle schools

Figure 7: Balanced comparison results of English classroom teaching

Figure 7 has depicted a bigger teaching balance inside the multimedia-focused ecological English classroom. In elementary education organizations, the traditional teaching pattern's teaching balance fluctuated between 66 percent and 78 percent. By comparison, during a period of five months, the ecological model has experienced an increasing tendency, rising from 76% to 84%. Speaking of secondary schools, the average teaching balance got promoted from 74% in the traditional teaching method to 83.6% in the ecological model.

### 3.4 Teaching Efficiency

English classroom teaching efficiency is an indicator that reflects the effect of English classroom teaching. The teaching efficiency of ecological English classroom teaching based on multimedia intelligent information technology and traditional English classroom teaching were compared, and the experiment lasted for 5 months. The comparison results of the teaching efficiency of the two kinds of English classroom teaching are shown in Figure 8.



(a) Efficiency of English teaching in primary schools

(b) Efficiency of English teaching in middle schools

Figure 8: Comparison results of English classroom teaching efficiency

Figure 8(a) depicts the comparison results of the teaching efficiency of two primary English classroom teaching methods. Among them, the teaching efficiency of traditional primary school English classrooms reached a minimum of 68% in the third month, and the average English classroom teaching efficiency was 72.4%. The average teaching efficiency of ecological primary school English classroom teaching based on multimedia intelligent information technology was 79.6%. Figure 8(b) describes the teaching efficiency comparison results of two kinds of middle school English classroom teaching. Among them, the average teaching efficiency of traditional middle school English classrooms was 78%, while the average teaching efficiency of ecological middle school English classroom teaching based on multimedia intelligent information technology was 83.4%. Therefore, the ecological English classroom teaching based on multimedia intelligent information technology has higher English classroom teaching efficiency.

## 4 Conclusions

English classroom instruction has made clear a lot of issues in the context of information-based education. The traditional method of teaching English to students involves lecturing to them, which causes an imbalanced growth of classroom education and poor English instruction. In this paper, the sustainable ecological construction of English classroom teaching was carried out, and multimedia information technology was applied to English teaching, so as to make English classroom teaching develop in a balanced manner. Through Fuzzy AHP, the indicators that affect the effect of English classroom teaching were calculated, and the ecological English classroom teaching and traditional English classroom teaching based on multimedia intelligent information technology were compared and analyzed. The experimental results showed that the application of multimedia intelligent information technology to ecological English classroom teaching can effectively improve students' academic performance, the level of teacher-student contact and the balance in the classroom. Ecological English classroom teaching can promote the development of English education and improve the efficiency of English classroom teaching. However, the comparison between the two types of English classroom teaching studied in this paper is limited to primary school and secondary school, and no research is carried out on universities. Therefore, the comparison of two kinds of English classroom teaching in universities would be the direction of future research.

## About the Author

This work was supported by Research on the Training Model for Intercultural Communication Competence Development in Foreign Language Majors under the New Liberal Arts Initiative (GH23417).(Shuling Yang)



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