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Research Article

English Online Hybrid Teaching Based on Internet-of-Things Information Technology

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In recent years, due to the epidemic, the country is vigorously developing online teaching, which further promotes the development of hybrid English teaching. Online and offline hybrid teaching combines face-to-face classroom and online teaching. Offline traditional classroom and online auxiliary teaching can complement each other. However, in actual teaching, mixed teaching still suffers some defects, which can undermine the learning outcomes. In this paper, the Internet of Things information technology is used to study hybrid teaching. Firstly, relevant core concepts are clarified. After that, this paper designs an English online hybrid teaching model based on Internet of Things information technology and verifies the feasibility and effectiveness of this model through experiments. The results show that, compared with the simple mixed teaching, the average score of students' final evaluation under this mode increased by 5.11 points. And the proportion of students with classroom interaction and autonomous learning also rose by 12.1%. This shows that under the promotion of Internet of Things information technology, the online hybrid teaching mode has great guiding significance for middle school English teaching.

1. Introduction

In recent years, online teaching is being gradually promoted in China, especially with the influence of the covid-19 pandemic. The organic combination of network teaching and traditional classroom teaching is hailed, and there forms a mixed teaching mode called "Online + offline." The mixed teaching mode features flexibility, convenience, diversified teaching methods, rich teaching resources, and various ways of interactive communication. In the teaching process, it adopts the way of "Online + offline," which can effectively play the role of guidance and supervision of the teachers. Students' learning ability is not restricted by time and space, so as to improve the students' learning efficiency. Mixed teaching modes, such as MOOC, SPOC, flipped classroom, micro class, and rain class, have gradually become the mainstream form of school education. However, there exist problems with the actual hybrid teaching. For example, students' enthusiasm and participation are still relatively at a low level, instructors' teaching design preparation can be insufficient, teaching evaluation is not comprehensive, and the construction of platform function is a lack of guidance. All these problems hinder the development of teaching and the progress of education.

To improve the situation, according to the current state of Hybrid Education and with the tools of Internet information technology, the present work intends to demonstrate a new English hybrid teaching model. It builds the bridge between the hybrid learning process and the practical teaching tool. Under the guidance of this model process, teachers conduct preteaching analysis, online teaching process design, offline classroom teaching process design, and teaching evaluation. It imparts knowledge step by step and in an orderly way, which is convenient for the students to access, construct, and internalize the knowledge. Secondly, in line with the characteristics of middle school English teaching, this paper applies hybrid teaching to curriculum practice through experiments, and students

complete the preview and learning tasks on the learning platform before class. Teachers elaborate on the knowledge points online or offline depending on the preview effect. It guides students to carry out corresponding listening, speaking, reading, and writing training and accumulates learning resources in the online teaching platform for students to review after the class. Therefore, online learning and offline classroom exercises reinforce each other. The test shows that a hybrid model of English teaching based on the Internet is possible and can achieve good teaching results.

The purpose of the present study is to demonstrate the application of information technologies in online and offline hybrid education. It focuses on the differences, advantages, and disadvantages of hybrid education versus online learning and offers a new perspective on the hybrid teaching environment. Through research and analysis, this paper proposes an ideal online and offline hybrid teaching process for the High School English course. It completes the current research on the development of the mixed teaching models and provides practical advice on the application of the mixed learning model in the setting of high school English teaching.

2. Related Work

In terms of theoretical research, experts and scholars from various countries have discussed the application and development prospects of Internet of Things technology in the field of teaching. To adapt to the development of the new environment in the 21st century, Salcedo and Espinosa integrated information technology into the teaching process. He made audio-visual equipment and media supplementary elements of teachers' teaching work, to ensure the rational use of information technology [1]. Szydo et al. proposed to impart knowledge of the Internet of Things in computer science case studies. He designed a Copernicus platform composed of two different microprocessors. He focused on the software aspects of IOT device design. The platform is applied to teach the introductory course of Internet of Things in the computer science course of AGH University of Science and Technology. He also investigated the students' mastery of the course and their love of the platform [2]. Kerem et al. introduced a teaching method of Internet of Things system course. This method uses widely available open source software and cloud platforms to strengthen the teaching of Internet of Things courses and guide students how to develop and complete the Internet of Things applications in real time at a reasonable cost. The results show that the designed method can help educate computer department students in time and actively it has had a constructive impact on the progress of Computer Engineering Education [3]. Omata and Imai conducted an exploratory study on PBL courseware of Internet of Things teaching materials in primary schools, aiming to investigate whether primary school students can use Internet of Things materials to solve problems in PBL programming classes. The experiment was conducted for 11 classes. After the course, the students' final works were analyzed from multiple angles. The study found that primary school students can use Internet of Things materials to solve problems, but they should ensure that they have enough time to think about the problems [4]. Mohammed et al. used Internet of Things text analysis to help teachers evaluate the students' classroom performance. He also collects students' feedback on Teachers' teaching and divides the feedback into positive feedback and negative feedback. This will help students improve the efficiency of listening and teachers optimize teaching methods [5]. To change the traditional teaching environment and improve the quality of school attendance, Guo and Sun designed real-time monitoring for a college-based online object class and cloud computing technology. It also suggests some new advanced algorithms. It captures different perspectives by capturing image data and processing data, and then combines the local environment with measurement data to capture students' physical characteristics. The test results show that the monitoring system is effective and can be applied to the physical education system [6]. Chen and Huang had designed an online English language learning program based on Internet of Things technology. He suggested three typologies for creating an online English-based Internet of Things tutorial [7]. The experimental results fully prove the effectiveness of the system.

3. Hybrid Teaching and Internet-of-Things Information Technology

3.1. Mixed Teaching

3.1.1. Meaning of Mixed Teaching. In modern society, with the rapid development of information technology, Internet is penetrating into the daily lives of people. As a result, curricula have begun to focus on combining the traditional education with online education. It is called hybrid teaching because teachers and students use the classroom and mobile terminal as a tracker under the guise of a combination of traditional school education and online education. Teachers aim to organize teaching activities based on learning content and student participation. It is a new teaching environment that allows students to plan their training according to their learning habits and skills [8]. Hybrid teaching can be simply understood as the effective integration of traditional classroom teaching and online teaching, as shown in Figure 1.

The connotation of mixed teaching can be understood from the following aspects: first, mixed teaching divides teaching into two parts. One part is traditional teaching with classroom as the medium: teachers and students communicate face-to-face in the classroom through multimedia, blackboard writing, etc., and the other part is the online teaching with mobile terminal equipment as the media: teachers send the teaching content to students' mobile terminal equipment through the sharing platform. Students reasonably plan their learning progress and complete teaching tasks according to their own time arrangement and ability level [9]. Second, mixed teaching puts forward more strict requirements for teachers: in traditional teaching, teachers present the learning content through face-to-face instruction with the help of PowerPoint and other teaching aids, which is relatively static and fixed. Mixed teaching

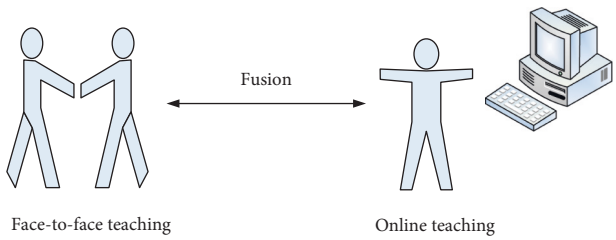

Figure 1: Blended teaching model.

requires teachers to consider not only students' learning ability, but also validity of the teaching content. It can adjust the design and arrangement of teaching activities in time according to the feedback of students, and the teaching process is more dynamic. Third, mixed teaching pays more attention to students' individual differences: in network teaching, mixed teaching takes into account students' basic knowledge levels and learning abilities. It respects individual differences and gives students time for autonomous learning to a certain extent [10]. Online teaching can enable students to enter the teaching situation with pertinence and "preparation" for the teaching content. It changes the original students' passive acceptance of knowledge. They actively participate in teaching activities, put forward their own views, and deeply explore knowledge.

3.1.2. Problems with Hybrid Teaching

(1) Lack of Enthusiasm and Participation on the Part of Students. Compared with the traditional classroom teaching, blended teaching can provide more learning resources. It gives more freedom and less restraint. However, as the student group is young, whose self-control is weak, and understanding of the concept of hybrid teaching is not clear enough, their attention can deviate from the learning content while using mobile devices in the learning process. Therefore most of the time, the learning device has become a tool for slack learning, which does not achieve the intended role of mixed teaching, rendering all the efforts futile. In the whole teaching process, students' participation and learning motivation are low, and their interest in learning needs to be improved.

(2) Teachers are Not Prepared for Blended Teaching. When teachers conduct mixed teaching online, they often use PowerPoint, text materials, test questions, and other forms. It is not much different from the PowerPoint demonstration in the traditional classroom. Teachers are not motivated to put enough effort into the preparation of mixed teaching design, which makes it difficult to stimulate students' interest [11]. As a result, the lack of diversity in mixed teaching leads to students' low classroom involvement and poor teaching outcomes.

(3) Teaching Evaluation is Not Comprehensive Enough. The middle schools that implement mixed teaching took the final score of the final exam as the only measurement standard, which results in the evaluation scheme lack of diversity and preciseness. It cannot give a thorough evaluation of students' real abilities, which discourages students' classroom expressiveness and enthusiasm for learning to a certain extent. The evaluation of students' self-regulated learning before class, the evaluation of classroom activities, and the evaluation of learning after class are not included in the final score accounting, but the final score of the final exam is the only measurement standard.

(4) Lack of Guidance for Platform Function Construction. There are a number of inconveniences with the functions of the platform. The construction of the platform ignores the feedback arising of students' real experience, and the setting of some functions is not considered from the perspective of students. For example, in terms of online Q & A function, the electronic version of the practice of raising and answering subjective questions is not as effective as the paper version as hand copying can enhance students' memory of information and knowledge. Worse still, the score ranking function can automatically publish the scores and ranking of all students, which will have a negative impact on the students who lag behind [12].

3.2. Internet-of-Things Information Technology

3.2.1. Connotation of Internet of Things. The Internet of Things is a new generation of information technology based on the Internet. It collects data through terminal sensors and uses information technologies such as radio frequency identification (RFID) and global positioning system (GPS). Internet of Things refers to the interconnection of things and people according to the proposed protocol, the interaction of data and information, and the extension and expansion of the network, for intelligent identification, positioning, monitoring, and management [13]. The essence of the Internet of Things is a network that can form a mutual perception among things, which is used to solve the interconnection problems from goods to goods and from person to person.

The basic characteristics of the Internet of Things are three-fold. The first is the perceptual characteristic. It can dynamically detect objects with the identification function through the identification device and read the attributes of the object. It also converts the information of the object into a form that can be carried out on the Internet, to achieve the recognition of the object [14]. The second is the transmission characteristic, which transmits the target information collected in the perception process through the network and transmits the target information in real time. The third is intelligence, that is, using cloud computing and other computer technology to mine and apply a large amount of data and information to realize the intelligent control of objects. Figure 2 shows the basic characteristics of the Internet of Things.

The technical system framework of the Internet of Things includes three parts: perception layer technology, that is, sensors are mainly used to realize the identification of things.

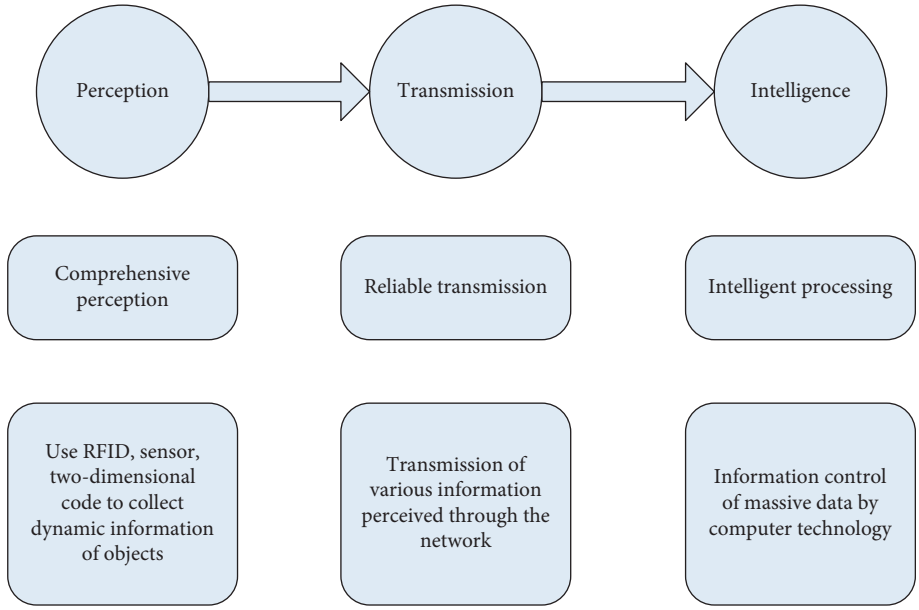

Figure 2: Essential features of the internet of things.

Network layer technology, that is, to realize the network transmission of data through the Internet. Application layer technology, that is, the combination of Internet of Things technology and relevant professional technology to realize the upper layer application [15, 16].

(1) Perception layer: it realizes the perception of objects and physical data collection, and constructs the perception layer by using RFID, sensors, and other technologies. The collected data includes various physical quantities and marks.

(2) Network layer: it processes the data collected through the network communication. It uses mobile communication technology and networking technology to quickly and reliably transfer the perceived information data to the information processing center. Internet of Things technology is used to optimize and protect the network of specific scenario applications to ensure smooth communication.

(3) Application layer: the construction of the application layer is the key link in the application of Internet of Things technology. Smart gas, smart home, smart logistics, smart power, and other industrial applications all belong to the application service layer. The application layer service mechanism should formulate the best implementation scheme for the actual application, change the traditional operation mode, reflect the advantages of Internet of Things technology, and design an intelligent Internet of Things system with simple installation and simple operation.

3.2.2. Communication Network Technology. At the same time, GSM network is not limited by the number of users and meets the availability of terminal equipment. It has also realized networking and roaming in China and has completed networking. Users can use it directly. GSM network covers a large area, which not only ensures the strong network capacity, but also saves a lot of network construction time and maintenance cost for customers.

GSM adopts time division multiple access (TDMA) and frequency division multiplexing (FDMA) technologies. GSM system includes four parts: mobile station, mobile network subsystem, BSS, and OSS. Its technical features include:

(1) Wide range of applications. GSM system has several frequency bands such as GSM900, GSM1800, and GSM1900. The characteristics of wavelength, penetration, and transmission distance of each frequency band are different. For example, GSM900 has long wavelength, poor penetration, and long transmission distance. Users can select the frequency band according to the actual application [17].

(2) Large system capacity. It uses concentric circle technology, dual frequency technology, microcell technology, multiple frequency multiplexing, MRP technology, and HCs layered cell technology to improve the capacity of the system and ensure the stability and reliability of the system when the number of system users increases.

(3) High voice quality. Using digital speech and digital modulation technology and Gaussian minimum frequency shift keying (GMSK) modulation mode, the antiinterference performance of network communication is good. At the same time, according to the characteristics of digital communication technology and the attributes of speech coding, the call threshold is set to maintain the quality of voice at a certain level.

(4) Open interface. GSM interface only specifies the interface, not limited to the specific implementation

form, including network interface and wireless interface [18]. The network interface has been basically standardized, so that different products can be freely interconnected. Wireless interface is the interface between the mobile terminal and network, which is composed of a physical layer, data link layer, and network layer.

Among them, the filter is an important device in GSM communication system, and its performance has an important impact on the communication quality of the whole system [19]. The relevant parameters of the filter are:

(1) Return Loss. Return loss represents the relationship between input power and reflected power, and its expression is determined according to the following formula:

$$L_R = 10\log\left(\frac{P_r}{P_i}\right) = 20\log\left|S_{11}\right|. \tag{1}$$

P_r is the reflected power and P_i is the incident power.

(2) Bandwidth. Absolute bandwidth refers to the upper and lower frequency values corresponding to the 3 dB attenuation in the passband. The upper frequency value minus the lower frequency value is the absolute bandwidth, that is

$$BW^{3dB} = f_H^{3dB} - f_L^{3dB}. \tag{2}$$

Relative bandwidth refers to the ratio of the absolute bandwidth to the center frequency, i.e.,

$$FBW = \frac{f_H^{3dB} - f_L^{3dB}}{f_0}. \tag{3}$$

Different from the filter, the antenna bandwidth is divided into absolute bandwidth, relative bandwidth, and frequency doubling bandwidth.

The absolute bandwidth of the antenna is

$$BW = f_h - f_1. \tag{4}$$

f_h and f_1 are the upper and lower limits of the antenna passband, respectively.

The relative bandwidth is

$$\text{band} = \frac{f_h - f_1}{f_0} = 2\frac{f_h - f_1}{f_h + f_1}. \tag{5}$$

f_0 is the center frequency.

The frequency doubling bandwidth refers to the ratio of the upper limit frequency to the lower limit frequency of the antenna passband. The frequency doubling bandwidth is also equal to the nth power of 2, that is

$$\Delta f = \frac{f_h}{f_1} = 2^n. \tag{6}$$

In antenna engineering, the impedance bandwidth of antenna is the most widely used, which is defined as:

$$BW = \frac{\text{VSWR} - 1}{Q\sqrt{\text{VSWR}}}. \tag{7}$$

q is the total quality factor of the antenna and VSWR is the voltage standing wave ratio.

(3) Insertion Loss. Insertion loss is an important index to characterize the signal transmission capacity in the passband of the filter. Its specific definition formula is

$$IL = 10\log\left(\frac{P_L}{P_{in}}\right) = 20\log\left|S_{21}\right|. \tag{8}$$

P_L is the power of the output of the filter and P_{in} is the power of the input of the filter. The insertion loss thus defined is negative, and the greater the insertion loss, the smaller the loss.

Transmission line resonator is the most widely used kind of resonator at present. It has the characteristics of simple structure and easy operation. The resonator composed of transmission lines with step impedance structure is called step impedance resonator (SIR). In practical applications, the method of using step impedance resonator (SIR) to generate dual frequencies is the most widely used [20].

Let Z_1 and Z_2 be the characteristic impedance of two transmission lines, respectively, then the impedance ratio is

$$R_Z = \frac{Z_2}{Z_1}. \tag{9}$$

Let the electric length of SIR resonator be θ_1 and θ_2, respectively, and the electric length of center frequency be θ_0, and satisfy the relationship:

$$\theta_1 = \theta_2 = \theta_0. \tag{10}$$

Let the input impedance of the quarter wavelength resonator be Z_i, ignore the discontinuity of the step connection surface and the edge effect of the open section, and the value of Z_i can be obtained according to the principle of the transmission line:

$$Z_i = Z_2\frac{Z_1\tan\theta_1 + Z_2\tan\theta_2}{Z_2 - Z_1\tan\theta_1\tan\theta_2}. \tag{11}$$

The condition for resonance of the resonator is the input admittance $1/Z_i = Y_i = 0$, so we can get:

$$Z_2 - Z_1\tan\theta_1\tan\theta_2 = 0. \tag{12}$$

Namely

$$R_Z = \frac{Z_2}{Z_1} = \tan\theta_1\tan\theta_2. \tag{13}$$

Let the first stray frequency of the quarter wavelength resonator be f_{s1}, the first stray frequency of the half wavelength resonator be f_{s2}, and the first stray frequency of the full wavelength resonator be f_{s3}. Then, for f_{s1}:

$$\tan\theta_{s1} = \tan(\pi - \theta_0) = -\text{arc}tan\sqrt{R_Z}. \tag{14}$$

The resonance conditions of half wavelength and full wavelength can be obtained by the following formula:

$$(R_Z\tan\theta_1 + \tan\theta_2)(R_Z - \tan\theta_1\cdot\tan\theta_2) = 0. \tag{15}$$

Because of $\theta_1 = \theta_2 = \theta_0$, therefore:

$$\tan\theta_0\left(R_Z + 1\right)\left(R_Z - \tan^2\theta_0\right) = 0. \tag{16}$$

From this, we can get:

$$\theta_0 = \arctan\sqrt{R_Z}, \tag{17}$$

$$\theta_{s2} = \theta_{s3} = \frac{\pi}{2}. \tag{18}$$

Thus, the stray resonance frequency of SIR is

$$\frac{f_{s1}}{f_0} = \frac{\theta_{s1}}{\theta_0} = \frac{\pi - \theta_0}{\theta_0} = \frac{\pi}{\arctan\sqrt{R_Z}} - 1, \tag{19}$$

$$\frac{f_{s2}}{f_0} = \frac{\theta_{s3}}{\theta_0} = \frac{\theta_{s1}}{\theta_0} = \frac{\pi}{2\arctan\sqrt{R_Z}}. \tag{20}$$

The greater the difference between the first resonant frequency and the stray resonant frequency, the better the filter performance.

4. Construction of English Online Hybrid Teaching Mode Based on Internet-of-Things Information Technology

According to the theoretical guidance of Hybrid Teaching and Internet of Things information technology, this paper designs the process framework of online hybrid teaching mode of middle school English course. The process design diagram is shown in Figures 3–6.

Figure 3 shows the preteaching analysis, including front-end analysis and teaching resource analysis. In the front-end analysis, teachers need to clarify the teaching objectives, teaching contents, teaching environment, and other related contents. It also obtains relevant teaching resources with the help of Internet of Things information technology, such as paper learning resources, multimedia learning resources, and Internet of Things information platform learning resources.

Figure 4 is the design of the online teaching process. Before the class, teachers choose appropriate teaching contents according to the specific learning situation of students and the requirements of the middle school English curriculum. It includes both general English and professional English teaching. In class, teachers conduct online teaching around the theme, explain the key and difficult points, conduct English demonstration, and communicate with the students. At the end of the class, the teacher will arrange homework, and the teacher will directly communicate and interact with the students. In addition, the establishment of an online Q & A class can enable teachers and students to better communicate after class. It can also enable teachers to better understand and grasp students' knowledge level and timely adjust the online teaching content.

Figure 5 shows the design of the offline classroom teaching process. The main purpose of offline classroom teaching is to establish a knowledge base for students, to establish a connection with these knowledge in online teaching and better understand and accept the knowledge. Teachers take the course units as a whole, summarize the subject knowledge, and let students watch the lectures of eminent teachers home and abroad through the Internet of Things, to enhance students' interest in learning. In terms of improving ability, teachers demonstrate and explain through listening, speaking, reading, and writing. It allows students to form study groups to practice, and teachers can correct mistakes in time in class and determine students' deep thinking failures. Finally, with the method of theme display, it puts forward themes related to the learned content, organizes group learning to discuss around the theme, and breaks through the closed knowledge base. It guides students to actively explore, engage in deep thinking, and activate knowledge schemata, to enhance the students' application ability. At the same time, it can also strengthen the communication and interaction between teachers and students, and thus creates a relaxed and lively classroom atmosphere.

Figure 6 shows the design of teaching evaluation. The teaching evaluation designed in this paper follows two principles: diversification of evaluation subjects and diversification of evaluation methods. The diversity of evaluation subjects requires not only teacher evaluation, but also students' self-evaluation and students' peer evaluation, and students' performance in the classroom is observed from a multidimensional perspective. The diversity of evaluation methods requires teachers to not only emphasize the summary evaluation of students, but also carry out diagnostic evaluation and summary evaluation of students.

Online teaching evaluation consists of the following five parts: classroom attendance (5%), online learning (25%), online discussion (10%), classroom tasks (10%), and classroom performance (50%), as shown in Table 1. Online learning, online discussion, and classroom performance are scored by teachers' evaluation, students' self-evaluation, and students' peer evaluation. Offline classroom teaching evaluation consists of the following six parts: classroom attendance rate (5%), midterm exam (25%), final exam (25%), classroom performance (20%), usual test (15%), and usual homework (10%), as shown in Table 2. Among them, classroom performance and usual homework links are scored jointly by teachers' evaluation, students' self-evaluation, and students' peer evaluation. It pays attention to the evaluation between teachers and students and promotes teachers and students' self-reflection.

5. Experimental Design of Online Hybrid English Teaching

To ensure the operability and effectiveness of this model, it needs to be applied in practical teaching. The experiment of online Hybrid Teaching is based on Internet of Things information technology, and it explores the feasibility and effectiveness of this model in practical application.

The subjects of the experiment were 60 students in class 2, the senior one of X Middle School. They were randomly divided into two groups, the experimental group and a

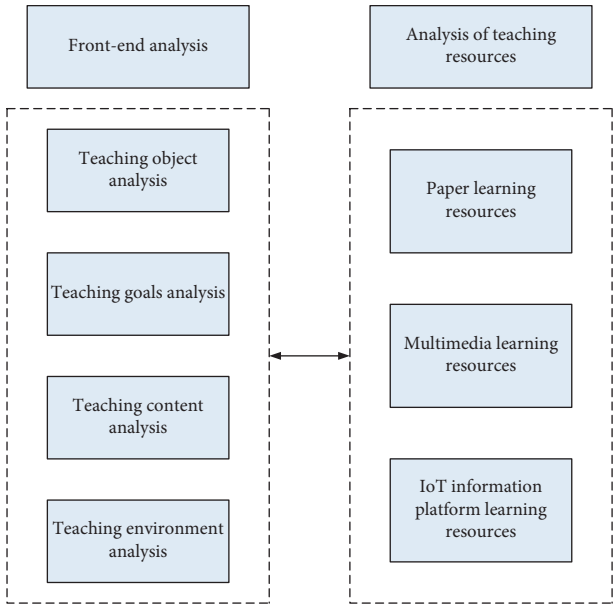

Figure 3: Preteaching analysis design diagram.

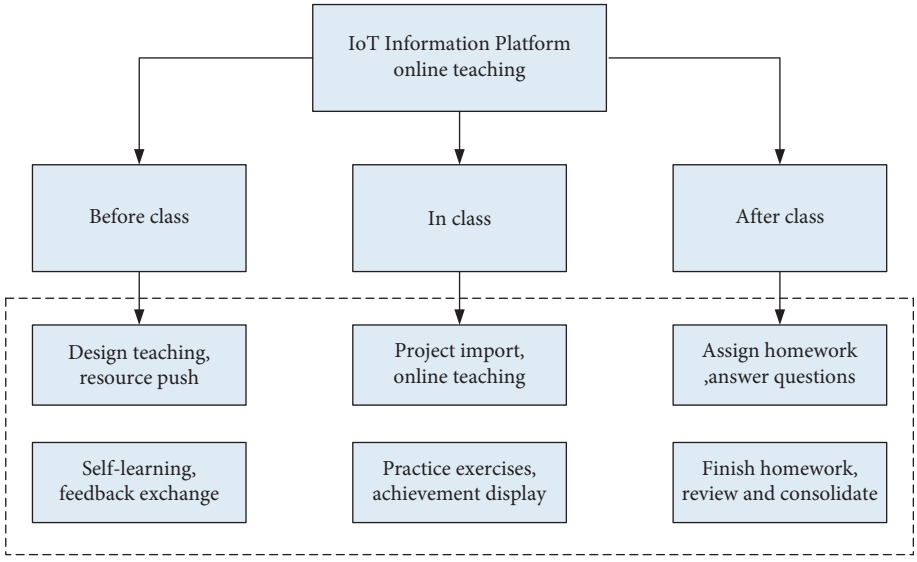

Figure 4: Teaching process design diagram of online teaching.

control group, with 30 people in each group. There was no significant difference in the initial average score between the two groups. This paper adopts the online hybrid teaching mode based on Internet of Things information technology described above for the experimental group, and the traditional hybrid teaching mode for the control group. This paper analyzes students' preview and review, classroom interaction and autonomous learning, curriculum resources, curriculum evaluation, and final evaluation results. The results are shown in the following figures. Figures 7 and 8 show the preview and review of the two groups of students, and the classroom interaction and autonomous learning of the two groups of students.

After the independent sample t-test, it is concluded that the difference probability value of the number of students in the two groups is 0.010.05, and the probability value of the difference in the number of reviewers is 0.030.05, indicating that there are significant differences between the two groups of students in the preview and review. In the online blended teaching mode based on the Internet of Things information technology, the number of students who spend more than 30 minutes in pre-class preview and after-class review is 4 and 6, respectively. In the blended teaching mode, the number of students who spend more than 30 minutes in pre-class preview and after-class review is only 2 or 3. Carrying out blended teaching in the Internet of Things information technology can enable most students to develop a good habit of pre-class previews and after-class reviews, and to fully prepare and review for the classroom learning.

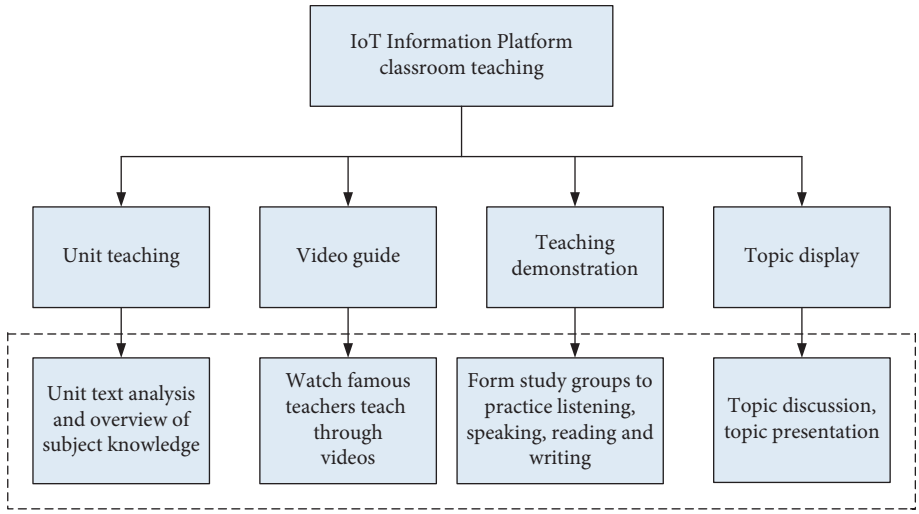

Figure 5: Teaching process design diagram of classroom teaching.

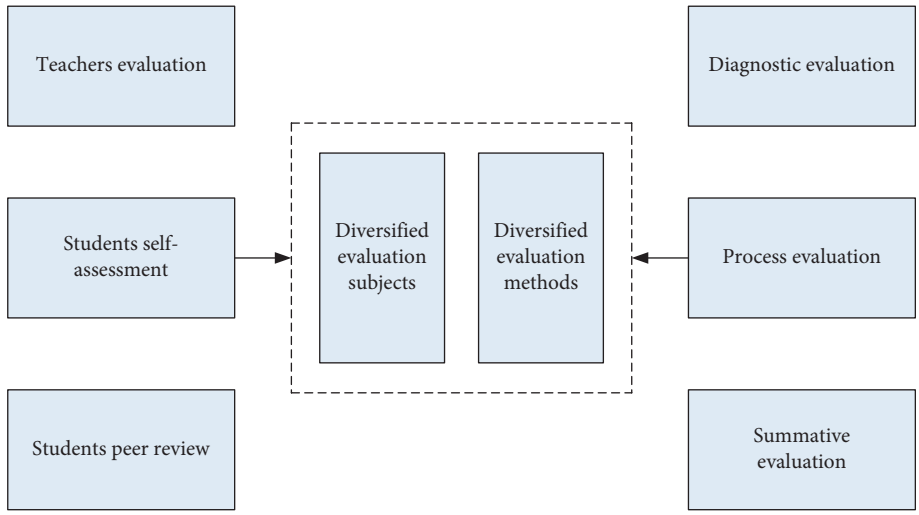

Figure 6: Teaching evaluation design diagram.

Table 1: List of online teaching evaluation indices.

Evaluation indicators	Indicator description	Weight ratio (%)
Attendance	Number of students online	5
Rate of learning	Learned video duration	25
Online discussion	Times of students participating	10
Online tasks	Students' completion of tasks	10
Online performance	Students' classroom performance	50

Table 2: List of offline classroom teaching evaluation index.

Evaluation indicators	Indicator description	Weight ratio (%)
Attendance	Students sign in	5
Midterm exam	Midterm exam grades	25
Final exam	Final exam grades	25
Classroom performance	Students' classroom performance	20
Usual test	Student's usual test scores	15
Usual homework	Completion of usual homework	10

The independent sample t-test results showed that there were significant differences in classroom interaction and autonomous learning between the two groups of students. In the online blended teaching mode based on the Internet of Things information technology, there are 18 students who actively participate in classroom interaction and 18 as well who actively engage in autonomous learning. In the blended teaching model, the number of students actively participating in classroom interaction and autonomous learning is only 5 and 9. It can be seen that after the students participate in the blended learning of IoT information technology, most students can participate in

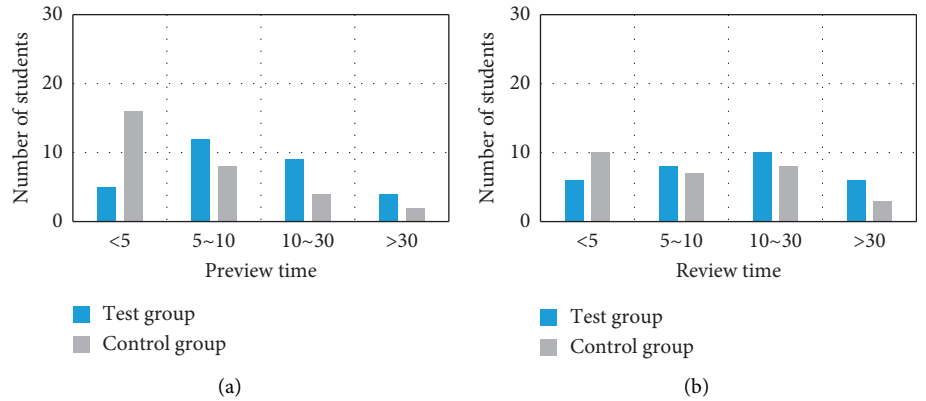

Figure 7: Students' preview and review situation graph (a) shows the preview of the two groups of students (b) shows the review of the two groups of students.

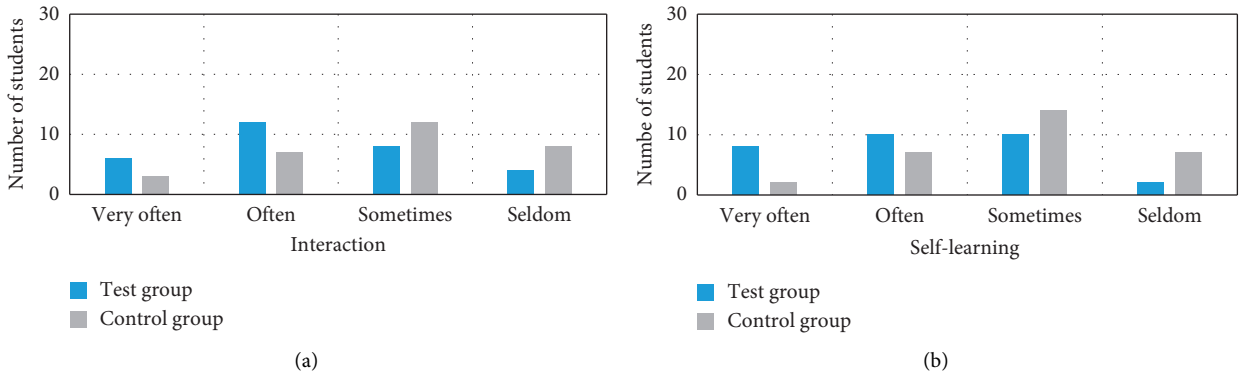

Figure 8: Graph of students' classroom interaction and autonomous learning (a) shows the classroom interaction between the two groups of students (b) shows the autonomous learning of the two groups of students.

Table 3: Statistics of the number of students selected by the rich curriculum resources.

	Test group	Control group
Excellent	8	4
Good	14	12
Moderate	7	12
Poor	1	2

Table 4: Statistics of the number of students selected for course evaluation.

	Test group	Control group
Excellent	9	3
Good	13	7
Moderate	6	2
Poor	2	6

classroom interaction and carry out independent learning plans. It improves students' sense of classroom participation and their autonomous learning ability.

Tables 3 and 4 show the statistics of the number of students who choose to investigate the rich curriculum resources and reasonable curriculum evaluation, and the corresponding percentage chart is shown in Figure 9.

As can be seen from Figure 9, under the online hybrid teaching mode based on Internet of Things information technology, 45.7% of students think that curriculum resources are rich and 23.9% of students think that curriculum resources are average. 44.9% of the students thought that the curriculum evaluation was reasonable and 18.7% thought that the curriculum evaluation was average. In the mixed teaching mode, most students think that the curriculum resources are average and the curriculum evaluation is average. The proportion of students who think that the curriculum resources are very rich and the curriculum evaluation is very reasonable is only 14.2% and 9.8%. It can be seen that after participating in the hybrid learning based on Internet of Things information technology, most students can participate in classroom interaction and implement autonomous learning plans, which improves the students' sense of classroom participation and autonomous learning ability. And it can also be seen that after students carry out the hybrid teaching based on Internet of Things information technology, the curriculum resources are much richer than the previous

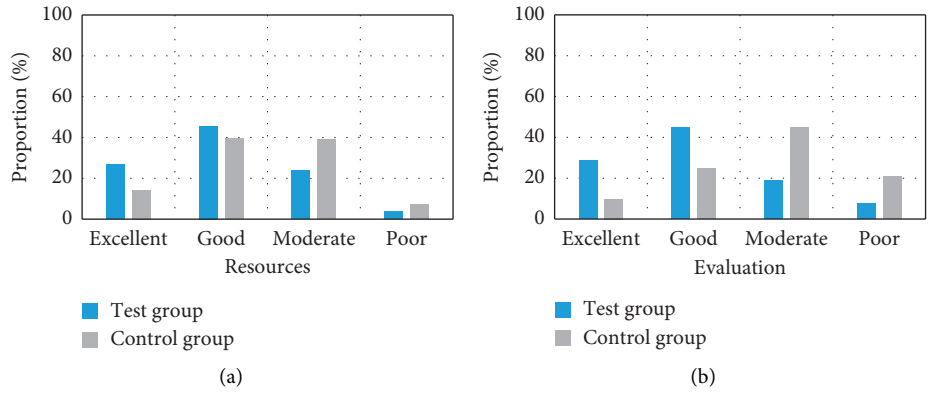

Figure 9: Percentage of students' opinions on course resources and course evaluation (a) shows the proportion of two groups of students' views on curriculum resources (b) shows the proportion of two groups of students' views on curriculum evaluation.

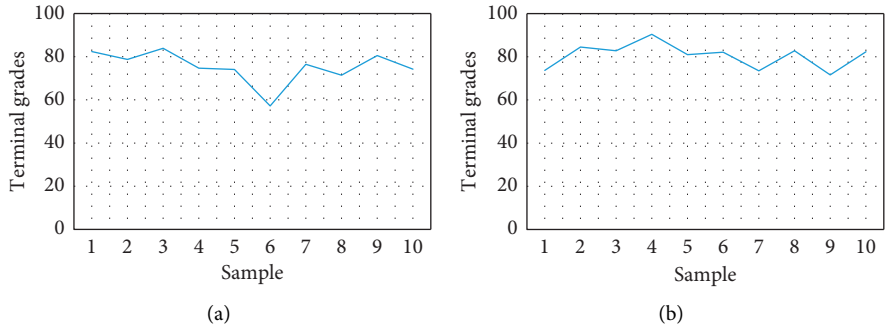

Figure 10: Graph of students' terminal grades (a) shows the final evaluation results of students in the control group (b) shows the final evaluation results of students in the experimental group.

hybrid teaching, and the way of curriculum evaluation becomes more reasonable.

After two months of teaching practice, the two groups were tested with the same English final test paper. 10 people were randomly selected from the experimental group and the control group to draw the comparative distribution of the final evaluation results, as shown in Figure 10.

As shown in Figure 10, in the context of the hybrid way of teaching based on Internet information technology, the average score of students is 80.47. The highest score is 90.4 points and the lowest score is 71.6. In the mixed learning environment, the average score of the students is 75.36, of which the highest is 82.4 and the lowest is 57.2. The average score of the experimental group is 5.11 points higher than that of the control class. It proves that the Internet of Things information technology has been effectively applied in a hybrid online learning environment, which can not only encourage students' interest in learning, but also promote improved student performance.

6. Conclusion

In the research process, it adopts the methods of literature research, investigation, and data statistical analysis, and this paper explains the basic structure of the Internet of Information Technologies. It analyzes the condition and shortcomings of the hybrid training. Combined with the Internet features of information technology and hybrid teaching, this paper designs a brand new hybrid teaching method based on the Internet of Information Technology. It tests the effectiveness of the model through an experiment. Overall, the experimental group's achievement was better than that of the control group. Following an online hybrid TRAINING course, students' participation in the preview, review, exercise, and classroom interaction has become generally better than that in the situation of a traditional hybrid classroom. However, this study only applies the Internet of Things information platform to middle school English curriculum, so the research suffers deficiencies. For example, there were too few subjects selected for a practical study, and its data is far from generalizable. The process design and practice of online Hybrid Teaching based on Internet of Things information technology has high complexity. In the future, we still need to deeply study and apply the functions of the online teaching platform. In the teaching design, it can present and organize the teaching content and knowledge points, and continuously optimize the teaching process and evaluation system. It is popularized and applied in more courses to meet the learning needs of students.

Data Availability

The data underlying the results presented in the study are available within the article.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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