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Application of IoT Intelligent Distance Education Technology in College English Teaching Reform

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Abstract: *English proficiency is an important component of the overall quality of college students. With the changing times, the demand for English learning among college students is becoming increasingly diverse. The traditional approach is teacher centered, with classroom teaching as the main focus, lacking interactivity and personalization. In order to improve the quality and level of teaching and promote the development of intelligent teaching, this article combines Internet of Things (IoT) intelligent distance education (DE) technology to study the reform of college English teaching. By constructing an IoT technology architecture, student learning data and individual attributes are identified, and relevant analysis and calculation of student learning behavior characteristics and learning outcomes are achieved. Customized learning plans and evaluation systems based on student characteristics are generated to provide intelligent learning services. The experiment uses empirical analysis research methods and questionnaire survey data analysis methods to analyze. The implementation results show that compared to before the application of IoT intelligent remote education technology, after the application of IoT intelligent remote education technology, 50 and 138 students in Class 1 and Class 2 are very active in English learning, respectively. The number of students who have a very positive attitude towards English learning is 17 and 101 more than before, respectively. The conclusion indicates that IoT intelligent DE technology can help improve students' enthusiasm for English learning, improve teaching quality and effectiveness.*

Keywords: *Internet of Things, Intelligent Teaching, Distance Education, English Teaching Reform*

1. Introduction

English is a necessary course for college students. However, if Chinese colleges and universities want to truly put people first, it is urgent to carry out college English teaching reform. The educational reform is not only the change of educational methods and means, but also the change of educational concepts. This should change from teacher-centered teaching of language knowledge and skills to student-centered teaching. This should not only change the teaching of language knowledge and skills to focus on language use, self-study and practice, but also change the goal of lifelong learning.

With the emergence and development of IoT and other technologies, intelligent DE based on IoT has gradually taken root in China. The traditional simulated language laboratory is gradually replaced by the English digital and networked autonomous learning center. As modern educational technology develops, the environment and conditions for English learning are becoming richer and the teaching methods are becoming better. The prospects for English teaching and learning are very broad. However, how to introduce modern educational technology and methods into the traditional field of education and carry out modern DE is a new problem faced by current Chinese educators. It needs to be deeply and carefully studied and boldly explored in order to build a modern DE system suitable for China's national conditions as soon as possible.

2. Related Work

As information technology continues to spread and progress in education, it is an inevitable trend to change the teaching of English in college. To enhance students' overall English level and promote the growth of college English teaching, Wang Ling proposed a strategic informatization of English teaching and learning reform, and used information technology in teaching English at the university

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level [1]. Gao Ying believed that the development and management of university teaching reform should be accelerated. The reform of English teaching should be deepened, and the campus environment should be improved. The demand for talents in contemporary society exceeded knowledge mastery, including imaginative thinking, analytical ability and problem-solving ability, which required improving teachers' own quality and ability and researching new teaching strategies [2]. Du Yanxia argued that independent learning to develop and improve college students' English had become an essential indicator of college English teaching reform. According to the experimental results, it was known that the independent learning of college English based on flipped classroom could significantly improve the overall English proficiency of students [3]. The above scholars believe that the rapid growth of information technology has promoted the process of college English teaching reform in China, which can meet the needs of students' personalized and differentiated learning in the information technology environment.

Modern DE takes the advantage of network transmission and emphasizes the openness and multimedia of English teaching, which fully reflects its huge development potential and prospects. Sadeghi Manijeh believed that DE was different from traditional education, which helped teachers and students teach and learn at home. The use of distance intelligent education allowed continuous communication between students and teachers as well as between students and students, greatly facilitating the process of English teaching and learning at the university level [4]. Annamalai Nagaletchimee's research focus was on how undergraduates used smartphones to complete online English courses. Smartphones could give students the opportunity to participate in teaching activities such as listening, reading, watching and browsing the Internet when learning English. In other words, they could help middle school students to carry out English learning activities by understanding how they use smart phones in DE [5]. The purpose of Benhima Mohamed's research was to explore students' feelings of using DE for college English learning. Students used social media and academic platforms to exchange English courses between teachers and students, and students had good views on distance learning. He suggested that professors and students cooperated to organize distance learning [6]. The above scholars believe that the rapid growth of English distance teaching has greatly expanded the growth space of English teaching reform.

The introduction of the IoT technology into DE to carry out college English teaching reform is a new topic, which needs to be comprehensively studied and discussed, and constantly practiced and summarized to finally form a new structure [7-8]. Many aspects, such as the process of implementing English teaching in DE, the transformation and realization of teaching concepts, and the construction of a new teaching model based on IoT technology, have been explored, so that a standard system of English teaching in modern DE is established and gradually promoted as a teaching standard [9].

3. English Teaching Reform Based on DE

Traditional English teaching methods cannot effectively improve students' comprehensive quality and their actual language level. To this end, the Ministry of Education of the People's Republic of China has carried out a comprehensive reform of English teaching and DE [10-11]. The purpose of the university English teaching reform is to develop students' comprehensive English language skills in order to use English to communicate effectively in their future studies, work and social activities, which in a way enhances students' autonomy and comprehensive cultural qualities.

3.1 Background of College English Teaching Reform

With the deepening development of globalization and the rapid progress of information technology, the importance of English as the main tool for international communication has become increasingly prominent. The traditional college English teaching model can no longer meet the needs of the new era and lacks interactivity and personalization. Students not only need to master the basic knowledge of English, but also need to have practical application capabilities. The reform of college English teaching is imminent, aiming to improve students' comprehensive English quality and practical ability by introducing modern educational technology and innovative teaching methods.

The popularity of distance education has provided new opportunities for the reform of college English teaching, especially during the epidemic, the advantages of online education have been widely recognized. The experiment uses questionnaires and data analysis to understand students' needs and feedback on distance English teaching, and provide a scientific basis for formulating more effective teaching strategies. College English reform is not only a change in teaching mode, but also an update of

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educational concepts, and is committed to cultivating compound talents that adapt to future development.

3.2 DE

DE, as an educational method recognized by the world, has also been applied in English teaching, and its characteristics should be obvious. Although the discussion and analysis of its characteristics are everywhere, there are few reports on the in-depth analysis and exploration of the specific characteristics of DE. Of course, feature analysis can be carried out from the aspects of technology, application, angle, demand, etc. Through the analysis of its characteristics, it is found that its ultimate goal is to make full use of its own characteristic advantages to truly achieve the purpose of improving human education. The characteristics of DE are shown in Figure 1.

As shown in Figure 1, the characteristics of DE are bidirectional, real-time and spatiotemporal, interactive and controllable. The two-way nature of DE can greatly expand the scope of teaching and learning, so that students can get more information and knowledge. Because the performance of network technology can fully meet the needs of real-time and space-time, the real-time nature of DE is often seen as the real-time broadcast of teaching content. Interaction is the biggest difference between modern DE and traditional DE.

Due to distance, one-way transmission and other factors, the controllability of distance teaching is often ignored, and people often regard it as uncontrollable. In fact, like other education methods, DE also needs to control and supervise the teaching process and teaching quality.

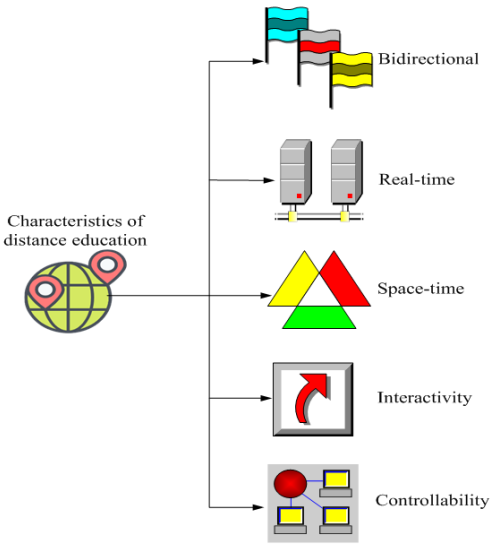

Figure 1: Characteristics of DE

3.3 DE Based on the IoT

DE in China is faced with a large number of students with a complex structure. Through the research of network technology, the optimal allocation of DE resources and large-scale resource diffusion can be achieved, thus achieving the goal of improving college English teaching reform. With the comprehensive promotion and development of college English teaching reform, network technology has been used to build an intelligent distance learning platform. The realization of personalized and intelligent education is an unavoidable trend in the growth of modern DE. The new way of DE is shown in Figure 2.

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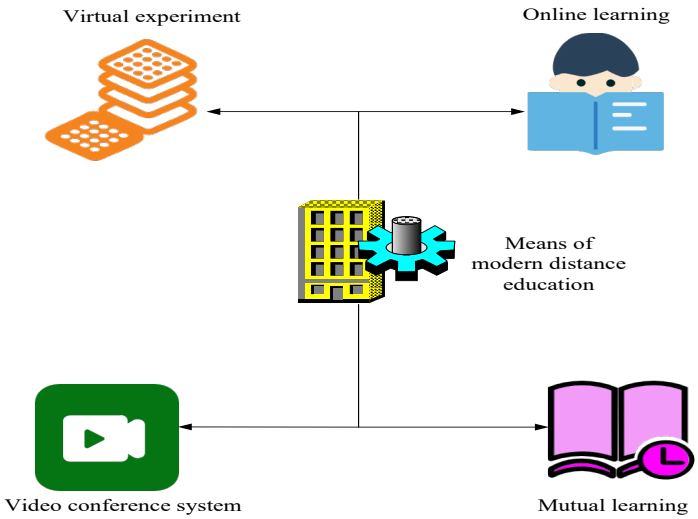

Figure 2: New ways of DE

As shown in Figure 2, the rapid growth of modern network and computer technology has provided conditions for the expansion of modern DE. DE has changed the current way of English teaching, forming a field teaching in different places and multiple points, rather than a simple post-teaching and learning evaluation, thus forming a large teaching room covering all schools. A quasi-site teaching system based on digital learning resources has been established.

Based on the needs of college English education and the characteristics of DE, this article constructs a DE architecture based on Internet of Things technology, as shown in Figure 3.

From Figure 3, it can be seen that the IoT DE architecture is divided into three layers: perception layer, network layer, and application layer.

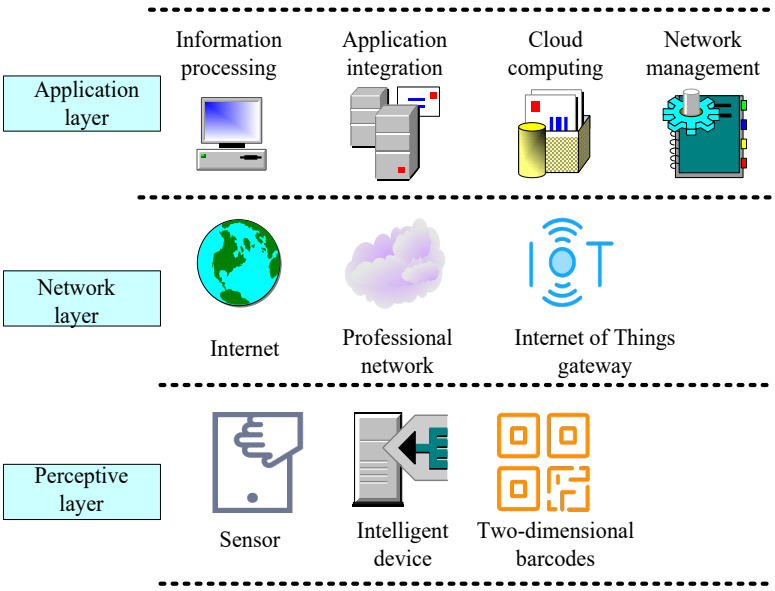

Figure 3: IoT DE architecture

1) Perception layer

The perception layer includes sensors, intelligent devices and two-dimensional bar codes. The perception layer is the lowest level of the entire architecture, mainly responsible for data collection and preprocessing. It utilizes sensors, intelligent devices, and two-dimensional barcode hardware devices to collect and analyze various types of information in the learning environment in real-time, and dynamically analyze them, achieving personalized and intelligent teaching for students. Among them, sensors are responsible for real-time collection of various information such as student learning time and attention. Smart devices include smartphones, tablets, smartwatches, etc., which are the main

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interactive medium between students and the Internet of Things architecture. Intelligent devices are mainly responsible for displaying teaching content, implementing corresponding interactive operations, and recording and transmitting student learning materials. And two-dimensional barcodes are responsible for fast and convenient information input, which can quickly obtain various resources. By scanning the QR code, students can quickly access teaching resources, submit assignments, or join class interactions. At the same time, teachers can also generate a QR code with homework assignments in remote classrooms, and students can scan it to see specific classroom requirements.

2) Network layer

The network layer includes the Internet, professional network and IoT gateway. After the students' information is transformed, special networks such as the Internet are used to transmit the transformed data to each central node or processing unit for analysis. The network layer achieves data transmission and interaction between the perception layer and the application layer through the Internet, professional networks, and IoT gateway technology. It can stably and quickly transmit data to cloud computing platforms, and then transmit it to intelligent devices in the perception layer to achieve real-time interaction and efficient teaching objectives. The Internet is the most widely used transmission channel in the network layer, which undertakes the task of long-distance data transmission. Through the Internet, teachers and students can connect with the teaching platform anytime and anywhere to carry out online teaching and teaching interaction. The Internet is used for distance learning. The integration of location technology and perception technology can better identify the real position of students and record their real learning time. The collection and analysis of data in DE is a very complex problem, and the use of IoT technology can achieve the collection and analysis of massive data. The intelligent DE model of the IoT is shown in Figure 4.

As presented in Figure 4, the intelligent DE model of the IoT is divided into three aspects: preparation module, learning module and evaluation module. The preparation module includes smart tag and smart course selection. The learning module includes intelligent learning, intelligent push and learning plan. The evaluation module includes intelligence evaluation and teaching effect feedback to realize the purpose of enhancing teaching and evaluation. Each module is supported by key technologies to build an intelligent distance learning system. The preparation module is the evaluation of students before formal learning and the key to the establishment of intelligent DE system. Learning module is the key to the implementation of intelligent education, and it is an optimization process of intelligent cycle. The evaluation module is a link for effective evaluation of teaching effectiveness. It can intelligently adjust students' evaluation to achieve the best teaching effect.

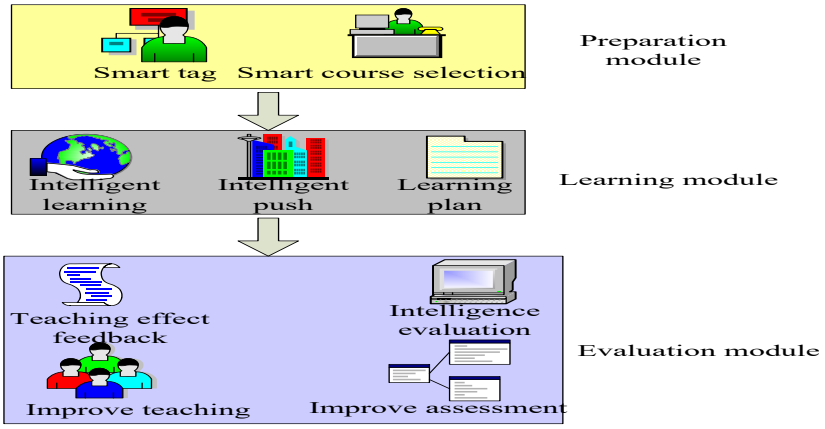

Figure 4: Intelligent DE model of IoT

Students can make anonymous evaluation of teachers' answers according to teaching resources and teachers' questions, so as to improve teachers' teaching quality. The system builds a huge database based on the data such as grades of each semester to evaluate and improve teachers' teaching resources and assessment methods.

And professional networks are divided into two categories: campus networks and educational private networks. In high-density teaching environments, it has the characteristics of high speed, stability, and reliability. By utilizing professional networks, information exchange can be achieved between various intelligent devices and teaching platforms during the teaching process. The Internet of Things gateway undertakes the function of information aggregation and transmission. This module is mainly responsible for transmitting various types of information collected by sensors to the cloud

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through various network protocols for subsequent processing. The Internet of Things gateway can collect data from different types of sensing devices and preprocess, compress, encrypt, and other processes to ensure the efficiency and security of data.

3) Application layer

The application layer is the top layer of the architecture, responsible for deep processing of data and providing various teaching services to students. The application layer analyzes and processes information from the network layer, generates personalized teaching content, and provides feedback to achieve overall management and optimization of the entire teaching process. The application layer includes information processing, application integration, cloud computing, and network management. The application layer is established as an intelligent learning platform for differentiated learning and evaluation, and provides intelligent learning services for students. The information processing module is mainly responsible for organizing, classifying, storing, and analyzing the data transmitted back from the network layer. It uses big data technology to extract useful information from massive learning materials, in order for teachers to grasp the progress and effectiveness of student learning. The application integration module mainly integrates various educational applications and services, forming a unified and collaborative educational ecosystem. It can be used to implement the integration and collaboration of teaching software, platforms, and tools, ensuring the interoperability of information and functions. Cloud computing technology can achieve real-time streaming of online courses and parallel processing of large-scale network testing, thereby ensuring the high efficiency and quality of system services. The network management module is mainly responsible for configuring, monitoring, and optimizing network resources, improving the efficiency of network resource utilization and the responsiveness of the system, and improving the teaching and learning experience.

4. The Effectiveness Evaluation of IoT Intelligent DE English Teaching

The process of English teaching is a process of exploration and innovation. Only by organically combining students' subjectivity and teachers' dominance, new ideas and methods can be explored continuously in the classroom to enhance the quality and efficiency of English teaching, so as to cultivate highly qualified and high-caliber applied talents who can accommodate the new situation.

This paper uses the questionnaire method to investigate 600 college students in a certain university in a certain city in order to understand the background of current English teaching reform and the needs of distance education, so as to put forward better suggestions.

4.1 Analysis on the Current Situation of English Teaching and the Demand of Distance Education

(1) Uneven English foundation

China's economic development is very uneven, with great differences in the east, west, north and south. There is a big gap between the coast and the mainland, as well as between rural and urban English education, which brings great challenges to English teaching. At the teacher level, it is difficult to prepare lessons in English teaching. If the teaching content is difficult, it is difficult for students in remote mountainous areas to understand. If the teaching content is relatively simple, students from cities also feel meaningless. The basic situation of students' English is illustrated in Table 1.

As shown in Table 1, 90 of the 600 students had a good English foundation, accounting for 15%. There were 39 students with good English foundation, accounting for 6.5%. There were 114 students with average English foundation, accounting for 19%. There were 177 students with weak English foundation, accounting for 29.5%. There were 180 students with very weak English foundation, accounting for 30%.

Table 1: Basic situation of students' English

Basic English	Number of people	Percentage
Very nice	90	15%
Relatively nice	39	6.5%
Commonly	114	19%
Weak	177	29.5%
Very weak	180	30%

Compared with ordinary universities, students under traditional English education face more problems. They can't translate what they have learned into what they have learned, and they don't

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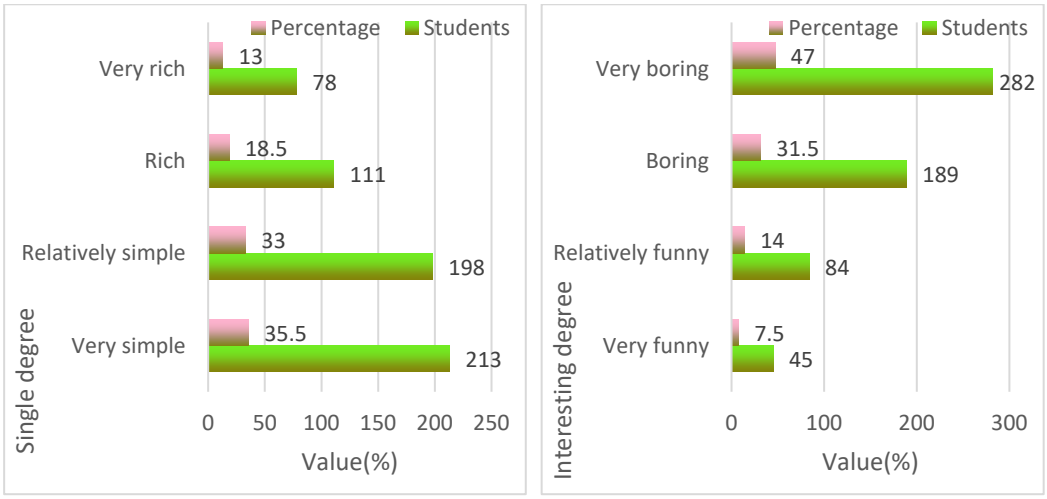
know how to learn. Most students feel that English learning is futile. They only pay attention to their professional knowledge. They feel that English is not good for their future work, so they don't pay much attention to English learning. In this case, some students who already have a certain degree of English knowledge are also affected thereby, resulting in a decline in English proficiency.

(2) Single teaching method mode and boring classroom atmosphere

At present, college English teaching is mostly based on theoretical teaching, while ignoring students' comprehensive application and listening training. Therefore, English teaching is still conducted in a traditional way. Traditional teaching is a static teaching with teachers as the main body. Students are passively accepting knowledge, while some teachers emphasize grammar. The teaching method is too single, and the students' subjectivity is ignored, resulting in students' lack of confidence, low interest, and monotonous classroom atmosphere. Therefore, students' learning efficiency is not high. The single degree of English teaching mode and the interesting degree of classroom atmosphere are shown in Figure 5.

As shown in Figure 5: According to Figure 5 (a), there were 213 students who thought that the English teaching mode was very simple, accounting for 35.5%. There were 198 students who thought that the English teaching mode was relatively simple, accounting for 33.0%. There were 111 students who thought that English teaching mode was rich, accounting for 18.5%. There were 78 students who thought that English teaching mode was very rich, accounting for 13.0%.



(a) The single degree of English teaching mode *(b) The interesting degree of the English classroom atmosphere*

Figure 5: Singularity of English teaching mode and interesting degree of classroom atmosphere

According to Figure 5 (b), 282 students said that the English classroom atmosphere was very boring, accounting for 47.0%. 189 students said that the English classroom atmosphere was boring, accounting for 31.5%. 84 students said that the English classroom atmosphere was more interesting, accounting for 14%. 45 students said that the English classroom atmosphere was very interesting, accounting for 7.5%.

Teachers should teach students according to their different characteristics. English games, storytelling and extracurricular activities are used to arouse students' interests, so that students and teachers can feel relaxed and happy. Communicative approach can also be used to guide students to communicate freely in English, instead of requiring all students to achieve the same effect at the same learning speed.

(3) Demand for DE

DE is a new teaching method using computer network, television, radio, text, video and other forms of teaching. The demand of students for DE is shown in Table 2.

As illustrated in Table 2, in the survey of 600 students, 291 students had a great demand for DE, accounting for 48.5%. There were 180 students with a large demand for DE, accounting for 30.0%. There were 63 students with average demand for DE, accounting for 10.5%. 54 students had a small demand for DE, accounting for 9%. There were 12 students who had very little demand for DE, accounting for 2%.

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Table 2: Students' demand for DE

Degree of demand	Number of people	Percentage
Very large	291	48.5%
Relatively large	180	30.0%
Commonly	63	10.5%
Small	54	9%
Very small	12	2%

4.2 Comparison of Results after Using IoT Education Technology

In order to understand the differences between students in the traditional English teaching method and the IoT based DE English teaching method, this paper divided 600 students into two classes with 300 students in each class. Students in Class 1 learned traditional English teaching methods for 3 months, and students in Class 2 learned English teaching methods based on IoT for 3 months. Finally, learning enthusiasm and learning effect were compared.

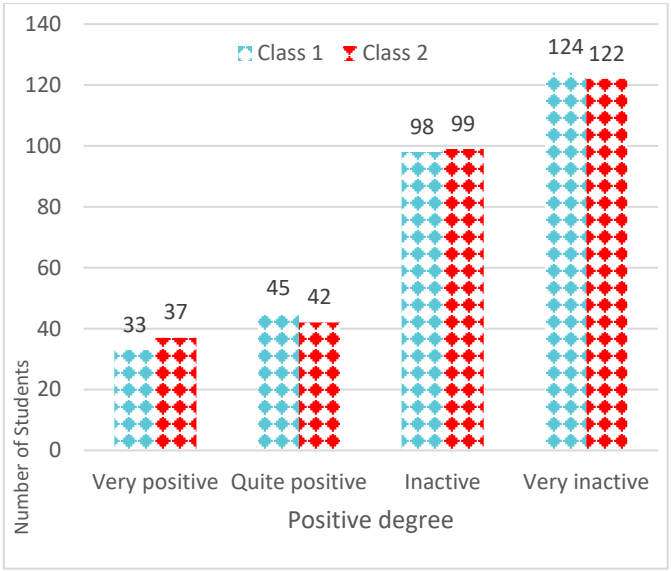
(1) Learning enthusiasm

DE has many advantages. Its main goal is to let learners feel a good learning carrier and a relaxed learning environment, so as to give full play to their enthusiasm and creativity, so that they can get better English experience in the learning process, and achieve better results. At the same time, DE also conforms to the development of college English, and has great development space in English teaching methods, quality of English teaching, and training of English ability. The students' learning enthusiasm before and after the test is shown in Figure 6.

As shown in Figure 6: According to Figure 6 (a), 33 students in Class 1 were very active in English learning before the experiment, and 45 students were more active in English learning. There were 98 students who were not active in English learning, and 124 students who were very inactive in English learning. In Class 2, 37 students were very active in English learning before the experiment, and 42 students were more active in English learning. There were 99 students who were not active in English learning, and 122 students who were very inactive in English learning.

According to Figure 6 (b), 50 students in Class 1 were very active in English learning after the experiment, and 54 students were more active in English learning. There were 92 students who were not active in English learning, and 104 students who were very inactive in English learning. In Class 2, 138 students were very active in English learning after the experiment, and 119 students were more active in English learning. There were 30 students who were not active in English learning and 13 students who were very inactive in English learning.

The courses of network courseware under DE are complete, rich in content and various, which can well meet students' understanding of English language and cultural background. Most importantly, it can realize individualized learning and make English teaching more flexible.



(a) Positive degree before test

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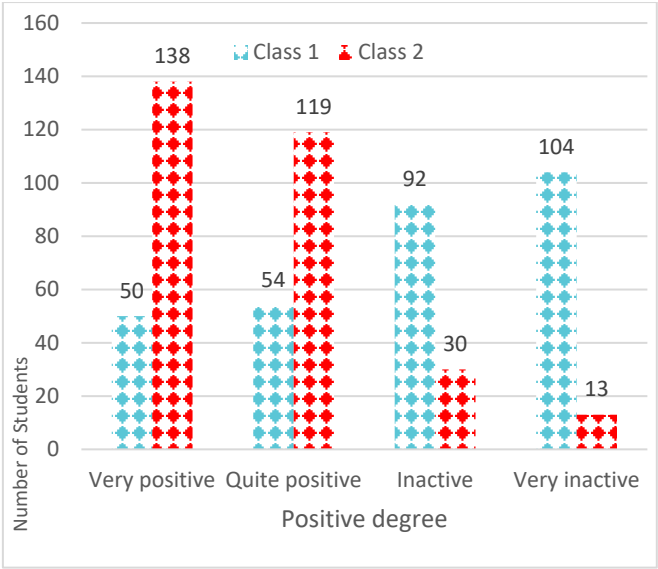
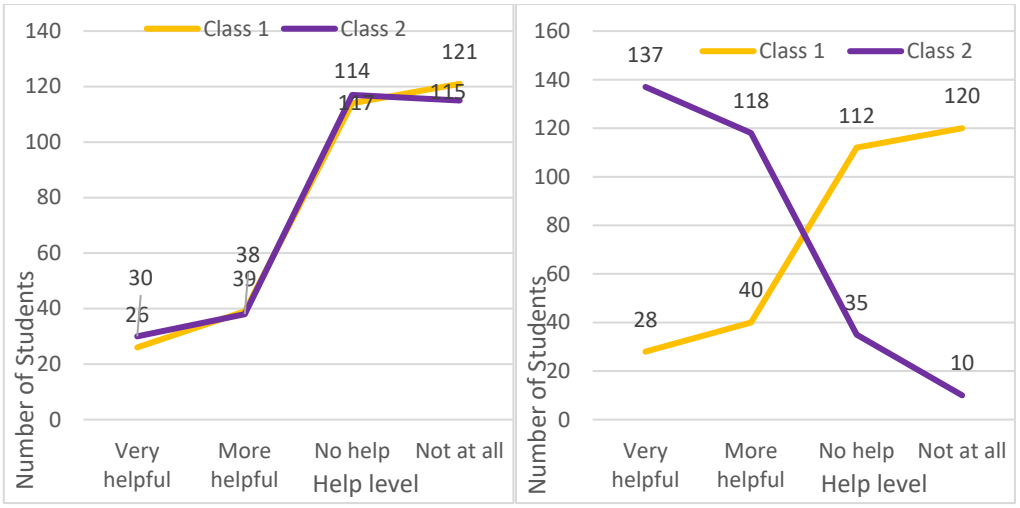


(b) Post-test enthusiasm

Figure 6: Students' learning enthusiasm before and after the experiment

(2) Learning effect

The use of IOT technology for modern distance learning has changed the traditional way of teaching management. The change of management mode has improved the management effectiveness of modern distance education and truly realized unified management and coverage management. The utilization of IoT technology to carry out modern distance teaching can change the traditional teaching mode from a single teaching mode to an interactive teaching mode that can be learned anytime and anywhere, thus enhancing the learning quality of students. The degree of help to their academic performance before and after the test is illustrated in Figure 7.



(a) Help level before test *(b) Help level after test*

Figure 7: Degree of help before and after the test

As illustrated in Figure 7: From Figure 7 (a), it can be learned that 26 students in Class 1 before the experiment showed that the teaching method of this class was very helpful to their academic performance, and 39 students showed that it was more helpful. There were 114 students who had no help and 121 students who had no help at all.

From Figure 7 (b), it can be seen that 28 students in Class 1 after the experiment thought that the teaching method of this class was very helpful to their academic performance, and 40 students thought it was more helpful. 112 students thought it was not helpful, and 120 students thought it was not helpful at all. In Class 2, 137 students thought that the teaching method of this class was very helpful to their academic performance, and 118 students thought it was more helpful. There were 35 students who thought it was not helpful, and 10 students who thought it was not helpful at all.

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With the utilization of IoT in modern DE, the traditional teaching evaluation model has been changed, so that the traditional lecture method is changed into a teaching method with classroom teaching scenarios.

4.3 Discussion

In the experimental analysis, this article verifies the effectiveness of the application of IoT intelligent DE technology in college English education reform from two aspects: learning enthusiasm and learning effectiveness. From the perspective of learning enthusiasm, compared to traditional teaching methods, after applying IoT intelligent DE technology, there are 50 and 138 students in Class 1 and Class 2 who are very active in English learning, respectively. The number of students who have a very positive attitude towards English learning is 17 and 101 more than before, respectively. From the perspective of learning effectiveness, before applying IoT intelligent DE technology, only 26 students and 30 students in Class 1 and Class 2 respectively believed that the teaching method was very helpful; After applying IoT intelligent DE technology, the number of students in Class 1 and Class 2 who believed that the teaching method was very helpful reached 28 and 137, respectively. The university English education model based on IoT intelligent DE technology can effectively improve students' English learning enthusiasm, meet their personalized needs, and to some extent improve the quality and level of their learning.

5. Conclusion

In the context of rapid development of globalization and informatization, traditional university English teaching models face many challenges and cannot fully meet the personalized and diverse learning needs of students. The Ministry of Education should improve the teaching mode of college English, enhance teaching quality and efficiency, and promote educational equity and resource sharing. This article explores the application of IoT intelligent DE technology in the reform of college English teaching. By constructing an IoT intelligent DE architecture, personalized learning experience and real-time interaction and feedback of remote English teaching are achieved. This not only improves the learning effectiveness and experience of students, but also enhances their interest and enthusiasm in English learning. However, this article also has corresponding limitations. The evaluation of the application effect of IoT intelligent remote education technology requires multi-dimensional data and indicators. This article only compares and evaluates the two dimensions of learning enthusiasm and learning effect, and the representativeness of the samples is still not broad enough. In future research, evaluation will be considered from multiple aspects such as learning behavior, grades, and feedback to improve research quality and promote the intelligent development of college English.

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