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Research Article

Cloud Classroom Design for English Education Based on Internet of Things and Data Mining

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The Informa ionization of social life and the globalization of economy have made the importance of English increasingly prominent. Building an information-based teaching platform for supplementary teaching under the network environment has become a mainstream teaching method in various basic schools. How to integrate various types of multimedia teaching resources into English classroom teaching has become the main goal of the current college teaching reform. Aiming at the shortcomings of the current English education classroom, this paper designs and develops an English education cloud classroom based on the Internet of Things and data mining methods. First of all, the system adopts a three-tier B/S model, the development platform chooses, NET, the development language, uses ASP.NET, and the database chooses SQL server. Secondly, the data mining method is used to clean and organize the data in the cloud classroom background to explore the course education status behind the data. Finally, the simulation test analysis verifies the efficiency of the English education cloud classroom established in this article.

1. Introduction

Institutions of higher learning are the specific implementation link of our country's talent strategy. In recent years, our country has vigorously promoted educational reform and educational technology application [1, 2]. The application of new technologies such as computer technology, information technology, and network technology has given a more positive development to the prospects of higher education [3, 4]. Through the survey, it is found that the application of most of the network platforms of colleges and universities is relatively single, and most of the network platforms have become educational affairs' platforms or network library platforms of major universities, and the teaching tasks are not completed as expected [5]. From the current technical point of view and teaching task requirements, it is not feasible to completely use the Internet teaching platform to replace manual teaching [6, 7]. However, it is feasible to use the Internet teaching platform as an auxiliary means of manual teaching or even as a teaching platform for elective courses [8, 9].

The use of big data technology can extract laws from massive data [10]. Through the practice of different industries, data mining, sorting, and analysis of massive data can provide effective decision-making reference [11, 12]. The same is true in the education industry. It is effective to introduce data mining technology to the network teaching platform to improve the learning effect and teaching management level of students [13, 14]. Using big data-related technologies to explore the internal laws between students, teachers, courses, grades, and other contents can provide a reference basis for the decision-making level of education and teaching and can also provide a guiding basis for the overall teaching task and teaching plan formulation [15, 16]. After observing the online teaching systems of several colleges and universities, it is found that the current online teaching platforms of colleges and universities are mostly the carriers of students' course selection, score query, and registration information [17]. From a functional point of view, the online teaching platform is more biased towards educational affairs system. Many students' learning information, school status information, course selection information, grades, and other contents are not related to each other, but in fact, there are connotative rules information that has not been used [18].

From the perspective of the functionality of the online teaching platform, the content of the platform is more static, and its dynamic personalized recommendation and evaluation functions are not yet mature [19, 20]. The Informa ionization of social life and the globalization of the economy have made the importance of English increasingly prominent. Building an information-based teaching platform for supplementary teaching under the network environment has become a mainstream teaching method in various basic schools. How to integrate various types of multimedia teaching resources into English classroom teaching has become the main goal of the current college teaching reform. Aiming at the shortcomings of current English education classrooms, this paper designs and develops an English education cloud classroom based on the Internet of Things and data mining methods. It is hoped that through the use of association rule algorithms, learning arrangements and teaching management can provide a strong basis to find out the key factors affecting the quality of teaching and provide assistance for improving the level of English teaching. In Section 2, we introduced the basic research of English cloud education classroom and the Internet of Things. In Section 3, we introduced cloud classroom design for English education based on data mining. In Section 4, we introduced relevant examples to verify. In Section 5, we summarize the relevant conclusions and future prospects.

2. Related Work

2.1. English Education Cloud Class. With the gradual deepening of distance education research, English distance education researchers have increasingly realized that comprehensive and systematic learning support services are the core element of maintaining the success of English distance education [21, 22]. Difficulty in interaction, weak learning ability, and lack of time are the three major obstacles hindering the success of distance learners. An important way to solve these difficulties is to develop and provide comprehensive and systematic learning support services for students. As a bridge between English distance education institutions and learners, learning support services aim to develop various services that meet the needs of students and help students solve learning difficulties [23]. With the advent of the era of big data and artificial intelligence, the learning methods, teaching methods, and cognitive methods of English distance education have undergone major changes. The characteristics of the era require new connotations to be injected into learning support services; from the traditional unified, the fixed learning support services have shifted to the development of personalized English teaching design, curriculum management, and learning evaluation services [24]. The conceptual diagram of English education cloud classroom is shown in Figure 1.

With the gradual deepening of research on English distance education, English distance education researchers have increasingly realized that comprehensive and systematic learning support services are the core elements to maintain the success of English distance education [25, 26]. Compared with full-time students, English distance learners are faced with the following three difficulties in learning under the premise of taking into account work and life. A characteristic of English distance education is that English teachers, students, and teaching institutions are geographically separated. The process of teaching and learning depends on various media and media. Therefore, there is a lack of timely and effective communication between teachers and students and students and students (see [27, 28]). To succeed in English distance education, in addition to the development and provision of well-designed and diverse learning resources by educational institutions, it also requires learners to have high self-learning ability and time-management ability. Secondly, English distance education is mainly based on online autonomous learning, so learners need to have certain computer skills and information technology foundation [29, 30]. English distance learners need to take care of work, study, and life and can only study in their leisure time and holidays, so they need higher learning efficiency. Once students encounter difficulties, they will have corresponding needs [31, 32]. If the needs are not met, these difficulties will cause English learners to lose interest in the course, gradually lose their passion for learning, learning arrangements and plans are chaotic, and ultimately lead to failure.

2.2. Overview of Mobile Information Technology. In recent years, mobile information technology has received extensive attention and development. Technologies such as edge computing and the Internet of Things have received more and more attention from researchers. Definition of the Internet of Things: the Internet of Things (IoT) can be regarded as a far-reaching vision with technical and social significance. From the perspective of technology standardization, IoT can be regarded as the infrastructure of theglobal information society, providing physical interconnection (physical and virtual) on the basis of existing and emerging interoperable information and communication technologies (ICT) advanced business. Through identification, data capture, processing, and communication capabilities, IoT can make full use of "things" to provide services for various applications, while ensuring security and privacy requirements [33].

The prevailing Internet of Things platform is essentially a centralized structure. Although the traditional Internet of Things is trying to use emerging distributed storage, edge computing, and other technologies, it has not changed its centralized nature [34]. In general, traditional IoT service platforms include server-side service platforms, IoT applications, IoT services, and client-side: full-function IoT devices, IoT gateways, and function-restricted IoT devices. Among them, the core of the "service platform" is network communication capabilities and application and business support capabilities. "Internet of things application" and "Internet of things business" are for the needs of mass users, commerce, and industry and are used to provide specific functional services. The provider is generally a company or

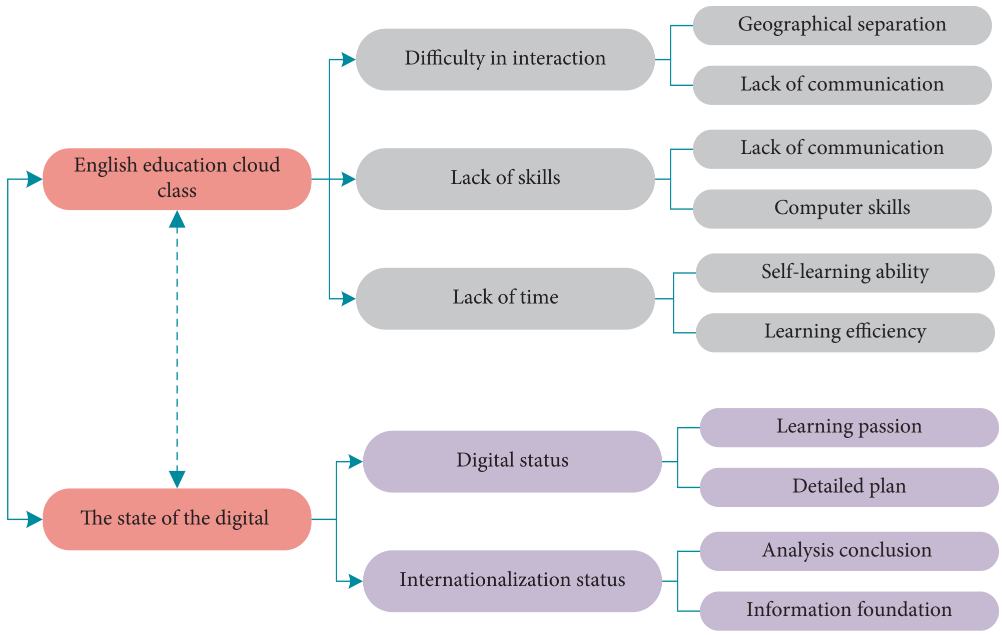

Figure 1: Schematic diagram of english education cloud classroom concept.

organization. "Full-featured Internet of Things devices" refer to Internet of Things devices with complete communication and working capabilities, such as smart phones and home electronic devices and industrial equipment that can directly connect to the Internet [35].

3. Cloud Classroom Design for English Education Based on Data Mining

Data mining methods include machine learning methods, statistical methods, neural network methods, and database methods. Among them, machine learning methods include inductive analysis methods (decision trees, rule induction, etc.) and genetic algorithms. Statistical methods include regression analysis (autoregressive, multiple regression, etc.), discriminant analysis (Bayesian discriminant, Fischer discriminant, and nonparametric discriminant), and cluster analysis. Neural network methods include feedforward neural network (BP algorithm) and self-organizing neural network. Database methods include multidimensional data analysis and OLAP methods. Among these methods, the following mining algorithms are commonly used: decision trees, association rules, Bayes, neural networks, rule learning, etc.

Gradient Boosting Decision Tree (GBDT) is a classic boosting algorithm. It is based on the idea of boosting algorithm, and in each iteration, a new decision tree is established in the direction of reducing the gradient of the residual and iteratively improves the generalization ability of the system. The gradient boosting decision tree is essentially a combination of multiple decision trees. The decision tree algorithm based on gradient boosting can identify distinguishable features and feature combinations. In the GBDT algorithm, the path of the decision tree can be directly used as the input features of other models, reducing the steps of manually selecting and combining features. Therefore, in the context attribute weight calculation, it is possible to identify context attributes that affect user preferences and to obtain the weight results of context attributes based on the relationship between context attributes, so as to dig deeper into user needs and provide users with more personalized Information recommendation. Conceptual diagram of decision tree data mining is shown in Figure 2.

Discretize each context instance under context attributes, convert them into input features, and input them into the gradient boosting decision tree. With the advent of the era of big data and artificial intelligence, the learning methods, teaching methods, and cognitive methods of English distance education have undergone major changes. The characteristics of the era require new connotations to be injected into learning support services; from the traditional unified, the fixed learning support services have shifted to the development of personalized English teaching design, curriculum management, and learning evaluation services. Since the gradient boosting decision tree algorithm is composed of multiple decision trees, each decision tree uses a top-down greedy algorithm to select the attribute with the best classification effect at each node to split:

$$\left\{\begin{array}{l} 1 \longrightarrow \\ 2 \longrightarrow \\ 3 \longrightarrow \\ \\ m \longrightarrow \end{array}\right. \begin{pmatrix} x_{11} & x_{12} & x_{13} & \dots & x_{1n} \\ x_{21} & x_{22} & x_{23} & \dots & x_{2n} \\ x_{31} & x_{32} & x_{33} & \dots & x_{3n} \\ \vdots & \vdots & \vdots & & \vdots \\ x_{m1} & x_{m2} & x_{m3} & \dots & x_{mn} \end{pmatrix}. \tag{1}$$

Therefore, the reference documents of this study measure the contribution degree of the situation instance to the user's choice based on the average change of the Gini index when each situation instance is used as a split node in each decision tree:

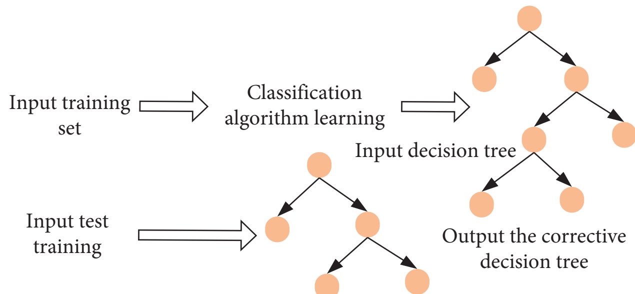

Figure 2: Conceptual diagram of decision tree data mining.

$$\text{st.}\begin{cases} \dfrac{\sum_{r=1}^{s} u_r y_{rj}}{\sum_{i=1}^{m} v_i x_{ij}} \leq 1\,(j = 1,\ldots,n), \\ v_i \geq 0\,(i = 1,\ldots,m), \\ u_r \geq 0\,(r = 1,\ldots,s). \end{cases} \tag{2}$$

Assume that M decision trees are obtained through the GBDT algorithm according to the user's preference information for selecting information resources and then the context instance Ck under the context attribute. The degree of contribution to the user's choice of information resources originates from the situational instance Ck:

$$Q = \begin{cases} Y = a_1 x_1 + a_2 x_2 + a_3 x_3 + a_4 x_4 + a_5 x_5, \\ a_1 + a_2 + a_3 + a_4 + a_5 = 1, \\ 0 < a < 1. \end{cases} \tag{3}$$

When M is used as a split node in a decision tree, there is no change in the average value of the Gini coefficient. Among them, the calculation formula for the Gini index of node and node is

$$\begin{cases} v_{ij}(t+1) = v_{ij}(t) + c_1 r_1(t)\big(p_{ij}(t) - x_{ij}(t)\big) + c_2 r_2(t)\big(p_{gj}(t) - x_{ij}(t)\big), \\ m_{ij}(t+1) = m_{ij}(t) + v_{ij}(t+1). \end{cases} \tag{4}$$

The priority of each attribute of the decision tree is usually based on the information gain:

$$Z_1 = -0.002Z_2 - 0.0869Z_3 + 1.6Z_4 + 0.385Z_5. \tag{5}$$

In addition, the Gini index and gain ratio are also commonly used to divide optimal attributes, where the gain ratio is expressed as

$$\max h_{j0} = \frac{\sum_{r=1}^{n} u_r y_{rj0}}{\sum_{i=1}^{m} v_r x_{rj0}}. \tag{6}$$

In order to prevent overfitting, decision trees usually adopt pruning methods to improve generalization:

$$\begin{aligned} t &= \frac{1}{\sum_{i=1}^{m} v_i x_{ij}}, \\ w_i &= t v_i, \\ \mu_r &= t u_r. \end{aligned} \tag{7}$$

Pruning is divided into prepruning and postpruning. Prepruning is based on the calculation result of information gain to determine in advance whether retaining nodes will increase the generalization of the model. Postpruning is to first generate a complete decision tree model and then proceed upward from the bottom leaf node. Investigate and decide whether to keep each node. For the situation where a sample can belong to multiple categories at the same time, the existence of the degree of membership is used to reflect the degree to which the sample belongs to a certain category. Fuzzy mathematics can express the fuzzy nature of things and relationships. On this basis, a fuzzy fault diagnosis model can be constructed to enable fault diagnosis to better handle the complex relationship between fault sources and fault symptoms.

4. Case Study of English Education Cloud Classroom Research

4.1. Case Analysis. The cloud classroom for English education based on data mining is an aid and extension of classroom teaching and is a tool to help students achieve after-class review and consolidate and reduce the workload of teachers. The biggest feature of the system should be reflected in individualization, that is, according to the characteristics of students, the information obtained by data mining should be used to dynamically select and organize the materials to be learned in teaching resources so that students can learn. Individualized guidance can be obtained in the selection of content, the understanding of learning goals, the evaluation of learning effects, and the diagnosis of the learning process, so as to truly realize teaching in accordance with their aptitude. The framework design of the English education cloud classroom system is shown in Figure 3.

The functional roles of the English education cloud classroom system can be divided into three types according to the user's authority, including system administrators, teachers, and students. For the situation where a sample can belong to multiple categories at the same time, the existence

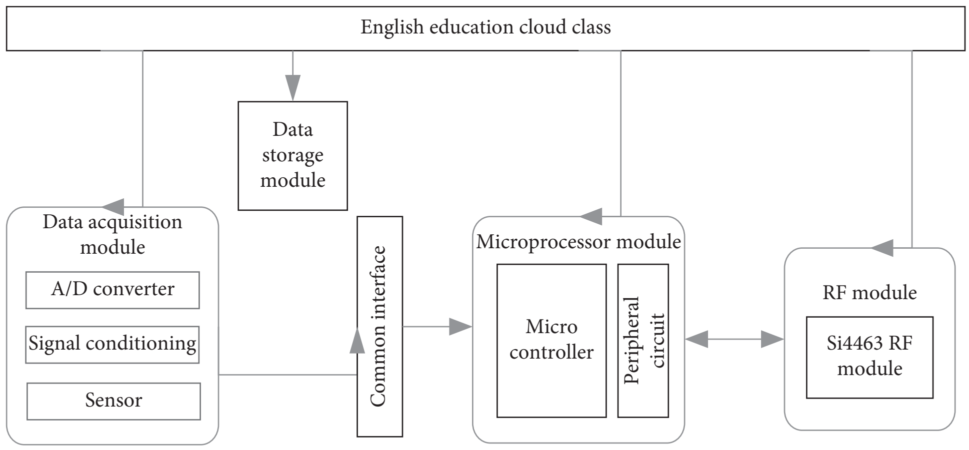

Figure 3: Framework design of the English education cloud classroom system.

of the degree of membership is used to reflect the degree to which the sample belongs to a certain category. Fuzzy mathematics can express the fuzzy nature of things and relationships. On this basis, a fuzzy fault diagnosis model can be constructed to enable fault diagnosis to better handle the complex relationship between fault sources and fault symptoms. The responsibilities of the system administrator include the maintenance and management of system information, user information, and user rights; the responsibilities of teachers include the management of teaching resources, through data mining of English student information to analyze and evaluate students' learning behaviors and adjust teaching strategies; students are in the system's personalized learning interface for autonomous learning, practice, testing, and answering questions.

4.2. Technical Testing and Application Effect Evaluation. In order to verify the impact of the English education cloud classroom system on the learning effect of students, this research applies the system to the undergraduate English exam tutoring course. The effectiveness of the system is tested through three methods: the pass rate of the English unified test, teacher interviews, and student questionnaires, and the application effects of the system are analyzed to find the direction for improvement in the later period. Distribution of score data in English education cloud classroom is shown in Figure 4.

Figure 4 shows the distribution of score data in different courses of English education cloud classroom, such as speaking, reading, and writing. The personalized learning path recommendation system English education cloud classroom system was formally applied to the tutoring process of the undergraduate English test of a university network education. Up to the time of data extraction, two batches of students have used the system. After students enter the English tutoring course for the unified test, they can see the learning path recommended by the system based on their history department data on the homepage, click on the link to get the corresponding learning content and learning resources, and participate in learning activities.

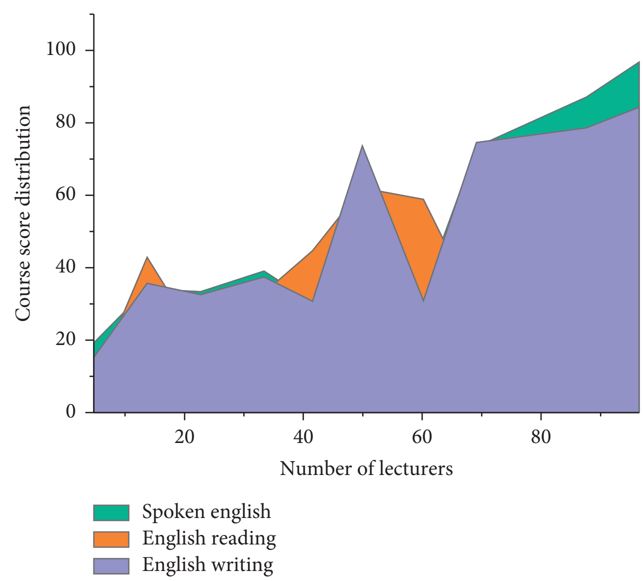

Figure 4: Distribution of score data in English education cloud classroom.

After the study is completed, the system will automatically mark the completed content. Teachers can use this system to provide students with personalized learning services and observe and record their learning progress. 75.9% of students think that, after using the system, their learning goals are clearer. This shows that most students agree with the navigation function of the learning path. Secondly, a total of 72.4% of students indicated that their learning time has been reduced after using the system. In contrast, 72.4% of students' learning initiative has been significantly enhanced, 82.8% of students said that the use of the system has mobilized their learning enthusiasm, and the number of logins to the platform has increased significantly. The number distribution of classrooms in different situations is shown in Figure 5.

Figure 5 shows the distribution of the number of classrooms in different situations, such as regular course time, weekend time, and holiday time. The results showed

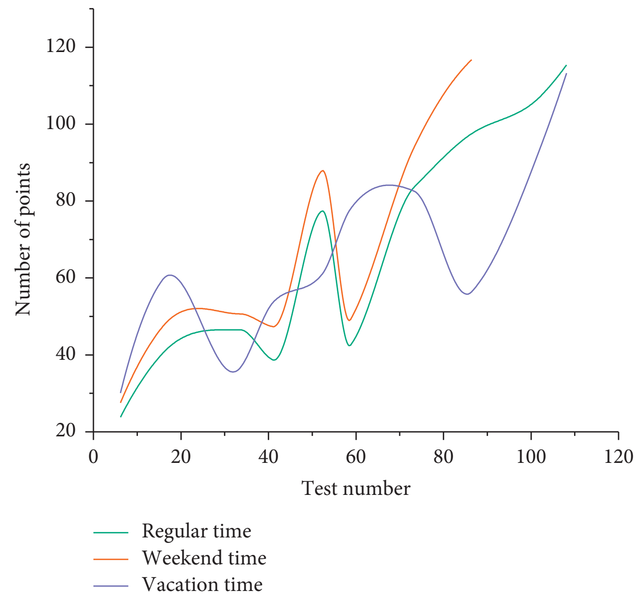

FIGURE 5: The number distribution of classrooms in different situations.

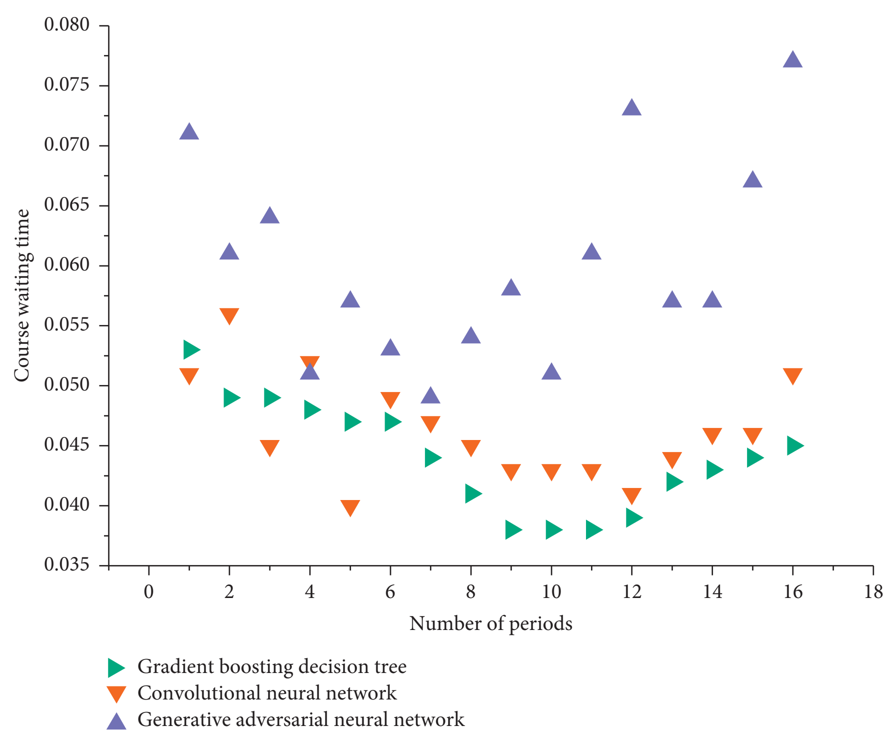

FIGURE 6: Comparison of english classroom based on gradient boosting decision tree and other methods.

that 72.4% of the students did not object to the learning sequence provided by the reference system, and the proportion of students willing to accept it was the highest. The functional roles of the English education cloud classroom system can be divided into three types according to the user's authority, including system administrators, teachers, and students. For the situation where a sample can belong to multiple categories at the same time, the existence of the degree of membership is used to reflect the degree to which the sample belongs to a certain category. However, the system still has obvious shortcomings. In the GBDT algorithm, the path of the decision tree can be directly used as the input features of other models, reducing the steps of manually selecting and combining features. Therefore, in the context attribute weight calculation, it is possible to identify context attributes that affect user preferences and to obtain the weight results of context attributes based on the relationship between context attributes, so as to dig deeper into user needs and provide users with more personalized Information recommendation. In addition, a total of 55.2% of students "strongly agree" and "agree" to add more personalized learning support modules to their studies because most students said that it would be difficult for them to only provide a personalized path recommendation function Feel the convenience and help provided by personalized learning services. The comparison between the English classroom based on the gradient boosting decision tree and other methods is shown in Figure 6.

Figure 6 shows the comparison between the English classroom based on the gradient boosting decision tree and other methods in this paper. Among them, we compare methods such as convolutional neural networks and generative adversarial neural networks. We used the waiting time of the course as an indicator for comparison [36–38]. We found that the gradient boosting decision tree model can maintain less waiting time and run smoothly. In the context attribute weight calculation, this method can identify the context attributes that affect user preferences and obtain the weight results of the context attributes based on the relationship between the context attributes, thereby gaining a deeper understanding of user needs and providing users with more personalized information recommendations. Convolutional neural networks and generative adversarial neural networks have also achieved good results, but due to differences in data samples and model matching, the above methods failed to achieve better results in the test. Although the system obviously helps students reduce the time for resource selection and decision-making and improve their learning motivation, 31% of the students still expressed that they are not optimistic about the probability of passing the exam and the effect of the system cannot be determined before the exam. In summary, the personalized learning path recommendation system provides students with a brand-new and effective learning method, which well demonstrates its goals and path navigation functions. Help students reduce resource search and decision-making time, stimulate students' interest in learning, and enhance learning initiative. The pointed learning resources and learning activities are not specific and detailed enough, and it does not consider the characteristics of students' learning styles.

5. Conclusion

From the current technical point of view and teaching task requirements, it is not feasible to completely use the Internet teaching platform to replace manual teaching. However, it is feasible to use the Internet teaching platform as an auxiliary means of manual teaching or even as a teaching platform for elective courses. With the rapid development of network technology, modern teaching has an increasingly urgent need for a mature network teaching platform. Based on this demand, it is necessary to develop and design network teaching systems and gradually apply them to teaching activities. It is necessary to improve the quality of education of. Combining the characteristics of autonomous learning and collaborative learning, comprehensively considering the needs of teaching management, resource sharing, and multidirectional interaction, this article creates a new type of English education network teaching system that conforms to the 21st century education information construction. The teaching system adopts the three-tier architecture of B/S in the choice of architecture. This choice can make the system's operating ability more improved and run more smoothly. With the advancement of information technology and network technology, more and more educators realize the importance of network teaching, and more and more network teaching systems are applied to teaching. Therefore, a new network teaching system that fully meets the needs of teachers and students can achieve more long-term development.

Data Availability

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Ethical Approval

This article does not contain any studies with human participants or animals.

Disclosure

All authors agree to submit this version and claim that no part of this manuscript has been published or submitted elsewhere.

Conflicts of Interest

The author declares that he has no conflicts of interest.

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