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Research Article

The Design Model of English Graded Teaching Assistant Expert System Based on Improved B/S Three-Tier Structure System

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With the continuous development of Internet technology, the modern education system is becoming increasingly intelligent. The integration of information technology with the traditional curriculum can unlock the potential of modern education, which is essentially a change from the traditional teacher-centered classroom teaching structure. The disadvantage of the traditional education system is that it is difficult to teach students according to their abilities because of the differences in English language standards caused by differences in their knowledge and learning potential. Although tiered teaching is one way of addressing this difference, it can have a negative impact in some ways, and implicit tiered teaching is a great solution to this problem. In addition, artificial intelligence is a science that studies the laws of human intelligence. The application of artificial intelligence technology to develop an expert system for teaching English can effectively solve the issues of insufficient teachers and a single teaching mode in the current education system. This will enable the sharing of teaching resources to effectively improve teaching quality, reduce the burden on teachers, and strengthen student' ability to learn on their own. This paper introduces the principles of artificial intelligence and the B/S three-tier structure system, analyses the current problems faced by English teaching, and proposes a solution for the implementation of a university English teaching aid system based on the B/S three-tier structure system. This system is based on the teacher English language teaching assistant expert system module, which uses a combination of generative and framework-based knowledge representations of the domain knowledge of English language experts to better enable teachers to understand their students' mastery of knowledge points. The results of this research show that the system can be used to help teachers understand students' learning through reasoning and analysis, and to improve students' interest, learning strategies and learning abilities in English.

1. Introduction

In recent years, the rapid development of Internet technology and information technology has accelerated the pace of mankind's entry into an information-based society. In order to adapt to this trend of rapid informatization of society, China decided at the beginning of this century to make information technology education universal in primary and secondary schools, with special emphasis on strengthening the integration of information technology with subject curricula and modernizing education through informatization. In this context, vigorously promoting the application of Internet in the teaching and learning process can effectively promote the integration of Internet technology with the subject curriculum, thereby bringing about changes in the way teaching content is presented, the way students learn, the way teachers teach and the way teachers and students interact [1]. Furthermore, this can bring the advantages of Internet into full play and provide a rich educational environment and powerful learning tools for students' learning and development. As a result, integrating Internet with the curriculum is of great significance in developing students' subjectivity and creativity, and fostering their innovative spirit and practical skills [2]. After all, the incorporation of modern information technology into educational reform and the educational process has become

an inevitable trend in today's educational world [3]. Also, the resulting blended approach to teaching and learning requires teachers and students to adapt quickly to such a blended approach to teaching and learning, as the integration of high technology into the curriculum is bound to benefit students. With the help of modern information technology tools, characterized by juice-computers, multimedia network platforms, and remote communication technologies, information-based teaching is widely used in the teaching process [4]. As a result, it is becoming a priority in the field of education.

With the rapid development of China's economy, English, as the world's lingua franca, is becoming more and more important in China's education system. In other words, the country and society are in urgent need of comprehensive and complex talents, and this places greater emphasis on students' ability to use English in practice. In this context, the reform of English language teaching at university has emerged [5]. The reform of English language teaching has now shifted the emphasis from developing students' reading skills to improving their overall practical skills [6]. This will not only develop students' ability to listen, read, write, and translate but also to understand the significance of phonetics in language learning and, in particular, to develop students' ability to communicate in English. The first requirement for students to communicate in English is that the speaker has a solid basic knowledge of grammar and vocabulary in order to convey information accurately and flexibly [7]. Many students do not have a solid grasp of the basics, which may limit their ability to improve their English. However, in practice, most teachers are oriented toward exam-oriented education [8]. They place too much emphasis on the teaching of grammar and vocabulary and neglect the development of students' practical language skills [9]. Although English teachers will communicate in English in the classroom, they are still influenced by the pronunciation of their mother tongue. The difference between the pronunciation of the listening materials in the common examinations and the pronunciation of the English teachers has an impact on both the students' performance in the examinations and their real learning of English [10]. However, the global development of information technology has provided new tools for education, and the birth and development of the Internet has provided a wider scope for education. The use of artificial intelligence in modern education can make learning an ongoing, lifelong process [11]. Actually, with the rapid development of artificial intelligence, there has been increasingly more intelligent algorithms, such as, BP neural network [12, 13], system dynamic model [14, 15], and life cycle assessment [16, 17]. In universities, the development of online courses is on the rise. How to embody intelligence in the teaching platform is a popular topic in all networked courses. Most of the currently available intelligent products are at the stage of experimental and theoretical research, and their degree of intelligence is limited and has not yet reached widespread application; therefore, the design of a network-based artificial intelligence-assisted teaching system is of great practical importance.

The traditional Chinese education system is based on classroom teaching. Indeed, the classroom teaching system can produce many outstanding students and can improve the efficiency of education, allowing for the teaching of many students in a short period of time. To a certain extent, the classroom teaching system facilitates access to education and saves educational resources [18]. However, there are some limitations to the classroom system. To be specific, the uniform teaching behavior does not focus on the developmental needs of individual students and prevents teachers from seeing the individual differences between students [19]. In this situation, students are not given the opportunity to develop their abilities and talents, and many students who are capable in areas other than learning are overshadowed. As a result, the traditional form of teaching puts students in a very passive position and does not allow them to fully develop their subjectivity. Teaching in this format is rigid and produces rigid students. At the same time, with the expansion of universities and the increase in the number of students, students are entering at different levels, and these differences are not only between majors and classes but also within classes. The traditional way of teaching places students at the same level, with the same teaching content, the same teaching methods, and the same teaching schedule [20]. This teaching style is therefore no longer sufficient to meet the learning needs of students at all levels. Moreover, the uniformity of assessment stifles students' interest and motivation in learning [21]. The uniform assessment of students by teachers does not see the real merits of students, which leads to a decrease in students' motivation to learn, which is not conducive to the overall harmonious development of students' bodies and minds [22]. Finally, the lecture mode of the classroom system reduces the opportunities for interaction between teachers and students, prevents teachers from attending to all aspects of individual students, increases the distance between teachers and students, and prevents students from being active learners. In the classroom teaching system, the individual characteristics of the learners are easily ignored and the learners' initiative is not effectively brought into play [23]. In addition, a uniform approach to assessment tends to stifle learners' interest and motivation. As people grow up, they develop differently due to biological and environmental factors. The fact that students with large differences enter the same class and are taught in a group class at the same pace inevitably leads to an inequitable distribution of educational resources [24]. In the face of students with very different levels of English language achievement, it is important to examine how general English teachers can meet the different needs of their students and improve the quality of their teaching, given that the current large class sizes cannot be changed.

With the effective reform of the teaching model, the classroom is increasingly dominated by the teacher in favor of the students, giving them more choice [25]. In contrast to the traditional classroom teaching system, students have more scope for independent learning in the modern English language-teaching classroom. Tiered teaching can greatly improve the disadvantages of the traditional classroom system. With the help of tiered teaching, teachers are able to

design English lessons in such a way that they are able to teach individual students with significant differences [26]. Once students have built up a sense of autonomy in their learning, external factors that facilitate learning are transformed into internal factors that not only increase their interest in learning but also develop their learning habits in the English classroom and improve the efficiency of teaching English. There is a broad theoretical basis for the study of English tiered teaching. From a psychological point of view, English language teaching is consistent with the development of students' personalities and their learning psychology. In English tiered teaching, researchers set multilevel teaching objectives according to students' psychological characteristics and individual differences, use a variety of teaching methods and various teaching tools to stimulate students' interest in learning from multiple perspectives so that each student can truly feel the joy of learning and promote their all-round development. There are two main types of stratification: explicit and implicit. On the one hand, explicit stratification, also known as in-class stratification, means that students are divided into different levels according to certain criteria and that students at the same level are regrouped into one teaching unit [27]. On the other hand, implicit stratification, also known as intra-class stratification, means that students are stratified and not taught in explicit classes, but are taught in a targeted way within the original classroom by teachers who know the students, in order to avoid negative psychological effects on them [28].

In China's current philosophy of education, the idea of teaching to the student's ability has become increasingly respected and valued. The tiered teaching model recognizes that there are differences in students' current knowledge, cognitive abilities, and emotional attitudes. Therefore, teachers should tailor their teaching to students' differences so that each student can make progress. As a result, tiered teaching is a good example of how to teach students according to their abilities. In the tiered teaching mode, students are stratified according to their cognitive level and learning ability, and students of similar levels of ability are placed on a single level [29]. It is only when the teacher has a true understanding of the students' personalities and their individual differences that he or she is able to work with them at their actual situation and learning level. This enables teachers to teach students in different ways so that they can develop and progress from their previous level of knowledge.

This study focuses on the different levels of students' English language proficiency and implements English language teaching in the B/S three-tier structure system. On the one hand, this system is in line with the human trend of integrating information technology with the curriculum. On the other hand, the intelligence of the system allows for automatic stratification. Specifically, the data analysis allows English teachers to understand the abilities of each student and to teach them on a tiered basis. In addition, the system allows for effective tiered teaching of student differences, thus protecting students' self-esteem and confidence and allowing each student to develop to the best of his or her ability.

2. Expert System

Artificial intelligence has developed rapidly over the last three decades, with a wide range of related applications and excellent results. Expert systems, as an important part of the discipline of artificial intelligence, are an emerging applied science that emerged and developed in the early 1960s. With the advancement of computer technology in the world, expert system technology has become increasingly sophisticated and mature [30]. Expert systems were introduced at a time when research into artificial intelligence was at a low ebb, and their successful application brought artificial intelligence out of the woods. This led to a major breakthrough from theoretical research to practical applications and from the exploration of general thinking methods to the application of specialist knowledge to solve specialized problems. Expert systems are intelligent computer programs that use knowledge and reasoning processes to solve complex problems that require the expertise of specialists and people in a particular field. To be specific, expert systems can be thought of as a type of computer intelligence program with specialized knowledge and experience that derives its capabilities from the expert knowledge it possesses. It generally uses knowledge representation and knowledge reasoning techniques from artificial intelligence to simulate complex problems that would normally be solved by experts, thus achieving a level of problem-solving capability equivalent to that of experts. From the first applications for experts to the present-day, expert systems have solved complex problems for companies, enterprises, and institutions of all kinds. And with the advent and development of the Internet, web-based expert systems have become very important. In addition, the emergence of new mobile devices, which can be connected to the Internet at anytime and anywhere without being able to access information, has created new demands for web-based systems. The creation of expert systems usually requires a certain level of technical knowledge and the concept of artificial intelligence.

2.1. Structure of Expert System. The structure of an expert system refers to the method of construction and organization of the components of the expert system. The functions and structure of an expert system vary according to its field of application and application goals. The structure of a traditional expert system is shown in Figure 1.

In the structure of expert systems, the user interface is the interface between the expert system and the domain expert or knowledge engineer and the general user, and is used for the input of data and commands, the output of results and the display of information. In English language teaching, it is used by the relevant experts to input and output knowledge and to update and improve the knowledge base. It is used by classrooms to input questions and facts to the system. The system outputs results or asks further questions of the user. The reasoning machine is the body that controls the work of the entire expert system and solves the problem. Based on the current user input data, the knowledge base is used to reason according to the inference

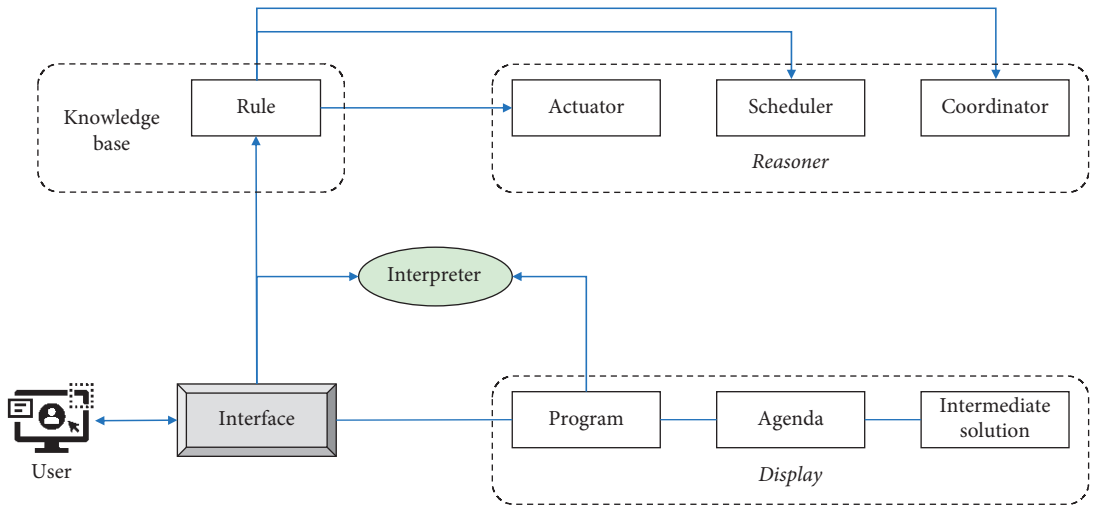

Figure 1: Structure of expert systems.

machine's strategy. Matching rules are selected from the knowledge base and the conclusion of the problem is derived by continuous reasoning. The performance of the reasoning machine is related to the representation and organization of the constructed knowledge, but is independent of the content of the knowledge, thus ensuring that the reasoning machine is relatively independent of the knowledge base. The interpreter explains the reasoning process and explains the behavior and results of the expert system to the user. Its strength reflects the transparency and trustworthiness of the expert system and is intended to make the reasoning process and the conclusions reached by the system more acceptable to the user.

Furthermore, the knowledge base is adopted to store domain knowledge, which contains a large number of facts and rules for all problem areas to be addressed. It is independent of all other parts of the system and the way in which the knowledge base holds knowledge is determined by the knowledge representation strategy and can be represented by one or more knowledge representations. The database is used to store the relevant data of the system, which can be the data entered by the user during the operation of the system, the results of intermediate reasoning, and the output after the solution of the problem. The contents of the database are constantly changing. At the beginning of the problem, the initial facts provided by the user are stored. The results of each step of the reasoning process.

2.2. Expert System in English Tiered Teaching. In English tiered teaching, the expert system can play an essential role in this field. To be specific, the human–machine interface is divided into a human–machine interface for teachers and a human–machine interface for students to interact with the system in order to increase the openness and interactivity of the system. An extended overlay model is also used for the student model, which includes a student behavior tracker and a student information store. The teacher model is based on a teacher knowledge tree that dynamically plans student learning content and dynamic interactive teaching strategies, including a strategy selector and a strategy synthesizer. The domain expert uses system knowledge as its external content and stores internal content such as the English curriculum, basic student information, basic teacher information, and basic curriculum information (see Figure 2).

The core of this system is the expert module, which is responsible for the following functions. As the source of all knowledge in the system, it is frequently called upon by other modules of the system to complete user behavioral responses in real time. Furthermore, the knowledge base is used to generate questions, tasks, and explanations. Students' knowledge is also evaluated, as well as their learning status and learning style preferences. In fact, knowledge representation is one of the primary issues that all intelligent systems must address. In order to increase the intelligence of the system and to facilitate computer implementation, the knowledge representation must be considered in a holistic manner, in order to facilitate a clear structure, reuse of code, and modular development.

In addition, the system uses the student module to build up an understanding of the student and to simulate the student intelligently by comparing student behavior with that of experts. As student modeling has become more sophisticated, various approaches to student modeling have been proposed, including coverage models, difference models, and interference models. The coverage model assumes that students' knowledge is a subset of expert knowledge at any given moment, and that the aim of teaching is to make students' knowledge converge to that of experts. The difference model is a refinement of the coverage model in that it divides expert knowledge into two categories: what students should know and what they do not want to know, and that student behavior that differs from expert behavior is not always considered wrong, but is treated differently, so that the model represents both the student model and the difference from the expert. The interference model adds a representation of misconceptions to the overlay model so that the student's knowledge is no

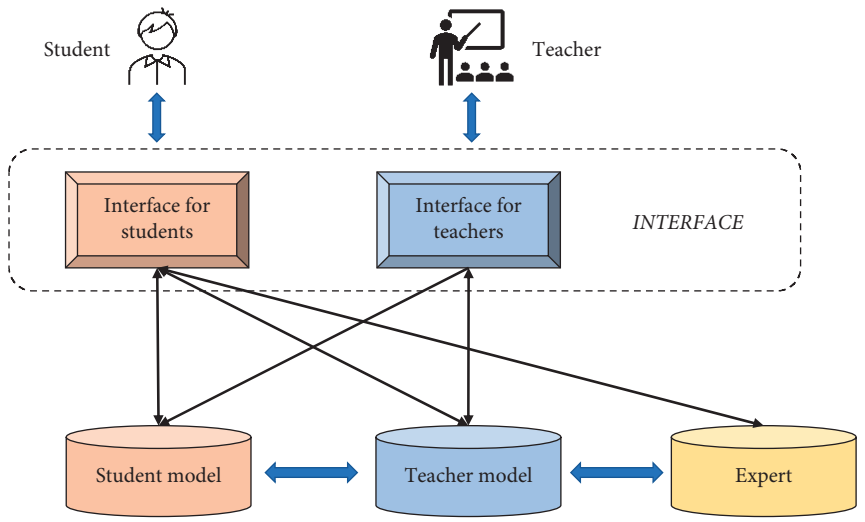

Figure 2: Expert system in English tiered teaching.

longer a subset of the expert's knowledge, but a representation of both the domain expert's knowledge and the misconceptions that the student may hold.

In summary, the expert system in English tiered teaching allows for different human–computer interaction methods to be used depending on the individual student. By selecting student-specific teaching strategies, the content is personalized to the student's English learning goals. At the same time, students can keep track of their learning progress and teachers can view their students' learning process at any time, allowing them to make timely adjustments to their teaching strategies.

2.3. Inference Method in Expert System. In the development of expert systems, the knowledge and information of experts is often uncertain due to the generally low rigor and precision of problem-solving in expert systems. In order to represent this uncertain knowledge in an expert system, in addition to the representation of uncertain knowledge, imprecise reasoning methods are also explored. Strictly speaking, uncertain reasoning is the process of applying uncertain knowledge to draw reasonable conclusions from uncertain initial evidence.

The most common forms of inference used today are forward and backward inference. Forward inference starts from known facts and leads to a final conclusion, so it is also called data-driven. The inference process is shown in Figure 3.

What is more, backward inference is also common. To be specific, backward inference begins by formulating hypotheses and then testing the truth of these hypotheses to find all the evidence or facts for the hypotheses to be true, hence the term "goal-driven." The inference process is shown in Figure 4.

Forward inference has disadvantages such as low efficiency, so the inference process may introduce many answers that are not relevant to the solution of the problem. Backward inference also may reduce the efficiency of the system if the assumptions are not realistic. To solve these problems, forward and backward inferences can be combined to their own advantage.

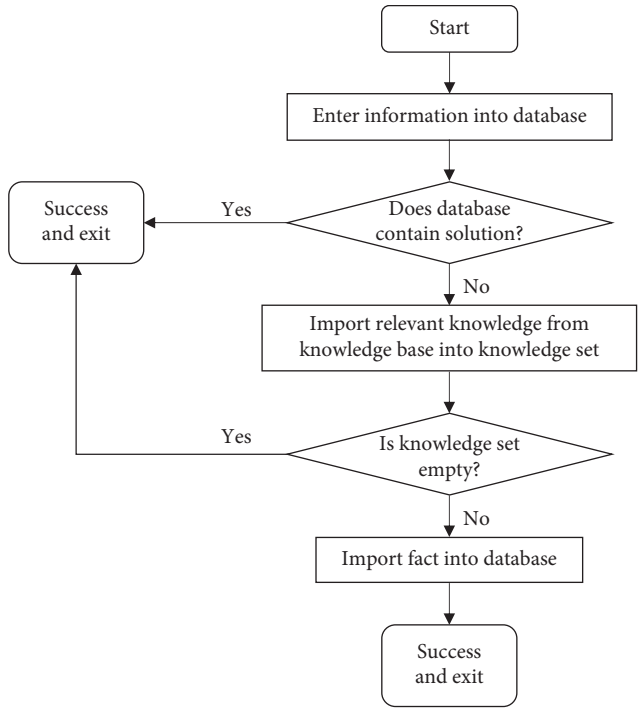

Figure 3: Forward inference.

3. B/S Three-Tier Structure System

B/S structure refers to the Browser/Server structure, which is a structure that has emerged with the development of Internet technology. The B/S structure has only one server installed and maintained, while the client uses a browser to run the software. In the B/S three-tier structure, almost all business processing is done on the middleware WebServer. The client only needs to install the browser and does not

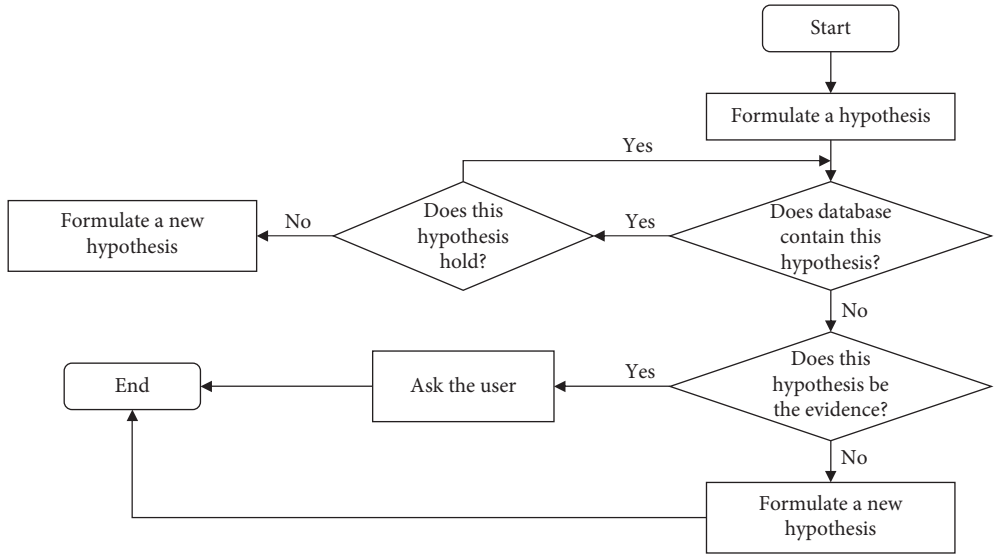

Figure 4: Backward inference.

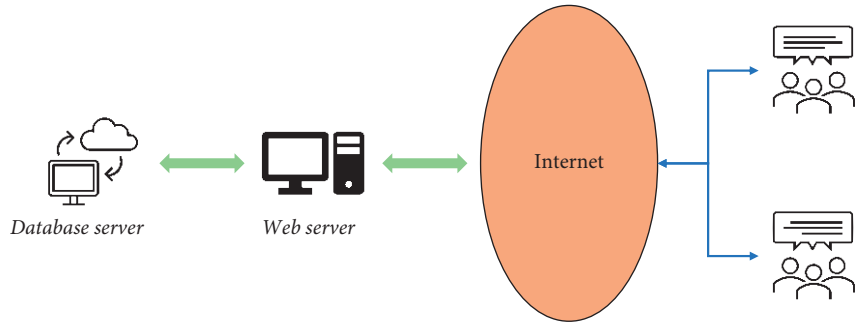

Figure 5: Framework of B/S system.

have to do any other installation or configuration work. To be specific, this system includes one Web server and one database server, which can be seen in Figure 5.

3.1. Framework of B/S Three-Tier System. There is no unified standard for the design of the B/S three-tier structure, and this study uses the more widely used three-layer structure, namely the representation layer, business logic layer, and data access layer. The B/S structure uses browser technology to achieve many powerful functions, thus saving development costs. This is the structure of choice for today's reference software and is shown in Figure 6.

The display layer is the outermost layer that provides the program and user interface. It is used to display data and to accept user input, enabling the user to interact with it. If the logistic layer is sufficiently powerful and well developed, it can provide services perfectly, regardless of how the display layer is defined. The logic layer enables the business of the application to be implemented. It mainly operates on specific problems and can also be understood as operating on the data layer. In addition to this, it is responsible for processing the information entered by the user, which is then sent to the data access layer for storage. The three-tier structure is a strict hierarchical approach, whereby the data access layer can only be accessed by the logic layer and the logic layer by the presentation layer. The user sends the request through the presentation layer to the logic layer, which then accesses the database to obtain the data through the data access layer after completing the relevant operations. The data is then returned in reverse order to be displayed on the representation layer.

In this research, the development and running environment of the web server for English tiered teaching is shown in Figure 7.

3.2. English Expert System Based on B/S Structure. According to the characteristics of English language teaching, the assessment and consolidation of basic knowledge is mainly reflected in the teacher's analysis of students' performance. As a result, the English expert system is primarily a rule-based expert system for the troubleshooting of student learning in English language teaching. In addition, the English expert system includes a learning function. Troubleshooting is the main function of the English expert system. The system accepts input from the English teacher and provides the English teacher with information about the student's knowledge, thus enabling the expert system to analyze the student's learning. The teacher

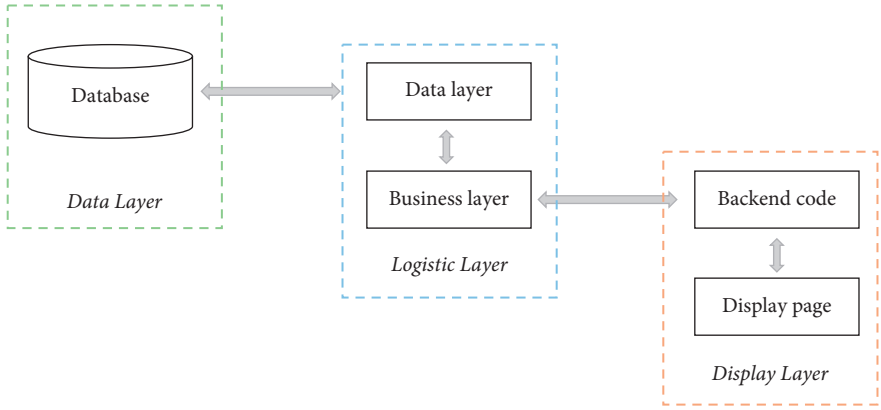

Figure 6: Framework of B/S three-tier system.

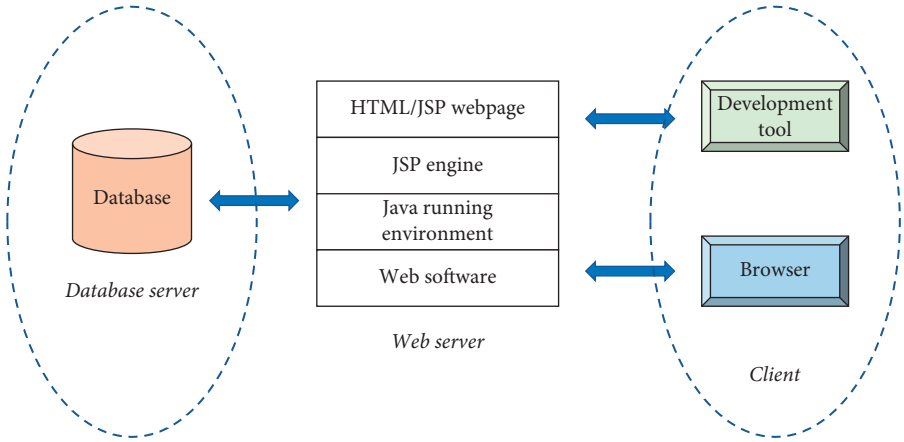

Figure 7: Development and running environment.

can then use the analysis to provide more targeted guidance to the students. The key to the troubleshooting function is the knowledge base of the relevant experts. Generally speaking, teachers can consciously assess certain points when organizing an exam. The teacher can therefore better tailor the teaching to the students once the diagnostic results are available.

3.3. Student Self-Directed Learning System. The main user of the student-directed learning system is the student. The system uses neural networks to assist students in their learning. The modern concept of education is that each student has his or her own unique learning personality and computer networks and provides the technology to support personalized learning. In personalized learning, the learning process is autonomous, but this is not a completely isolated learning process. In practice, it is unrealistic for each student to receive one-to-one tutoring and assistance from a teacher. The best way to achieve this is to set up an intelligent web-based, self-directed learning system, where the self-directed learning system takes on the role of a tutor and enables intelligent management of English learning.

4. Conclusion

The B/S three-tier structure-based English teaching aid expert system designed in this paper uses a combination of generative and framework-based knowledge representation methods and uncertainty-based reasoning techniques to enable English teachers to assess the basic knowledge of groups of students. This method enables the assessment of single classes, multiple classes, single colleges and colleges as a whole, thus reducing the teaching load of teachers and improving the quality of teaching. However, the English teaching aid system designed in this paper is only a teaching aid for basic knowledge in accordance with the characteristics of the English teaching reform which reduces the consolidation of basic knowledge. In order to make the system more practical and intelligent, the system also needs to assist students in the training of subjective questions, thus making the English teaching system more functional, which will be the main focus of the next step. In the future, further deeper communication with the English language teaching team is possible to deepen the knowledge and understanding of the English language teaching reform and to optimize the existing modules.

Data Availability

The labeled datasets used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare no conflicts of interest.

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