

Research Article

Innovative Research on College English Teaching Mode Based on Strategy Reasoning Mechanism

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In the era of artificial intelligence, the traditional English teaching methods cannot meet the increasing demand of course learning at this stage. Therefore, in this paper, a brand-new English teaching model based on strategic reasoning mechanism is designed by analyzing the problems faced by construction of network curriculum in universities. By introducing the idea of artificial intelligence, the student model and teacher model are designed, and the separation of teaching content and teaching strategy is realized. The development of the system adopts B/S structure and relies on lightweight J2EE multitier framework. At the same time, the overall architecture, functions, and processes of the teaching system are analyzed and designed. The system is convenient to transplant and expand, which has certain practical value and can provide reference for the design of various teaching systems and the innovation of teaching modes.

1. Introduction

With the continuous penetration of information technology into the field of education, artificial intelligence has played an important role and has been paid attention to and recognized by more and more educators [1, 2]. Artificial intelligence, as a rapidly developing technology, has brought new advantages to the reform of college English teaching and provided a possible path for the construction of efficient and high-quality college English teaching. The interaction and infiltration between artificial intelligence technology and college English teaching has promoted the diversified development of teaching methods and modes, thus playing an active role [3]. Reform of college English teaching from the perspective of artificial intelligence is reflected not only in the improvement of teaching quality, but also in the improvement of students' interest in English learning. It is conducive to upgrading college English teaching from static passive learning to dynamic active learning, thus leading to the overall optimization of college English teaching ecology [4]. Relying on artificial intelligence, the teaching of listening, speaking, reading, and writing can be more vivid and three-dimensional, thus creating a modern intelligent English teaching system which is

not to promote the complication of college English teaching, but to use advanced technology to present English in the simplest and most popular way for students, creating new perspectives and possibilities for college English teaching.

With the rapid development of artificial intelligence and network technology, web-based foreign language teaching websites or software appears one after another. However, the current online English teaching systems are mainly based on students' self-study and teachers' off-line answers, where students cannot get corresponding guidance [5]. In addition, there are also numerous English databases, online dictionaries, and online translation websites on the Internet. These tools can only translate and explain specified words and phrases, but cannot analyze a certain sentence and actively give learning guidance. Therefore, it is of great significance to study a new English teaching model with intelligent analysis function and corresponding learning guidance for different students.

2. Related Theories

2.1. Object-Oriented Knowledge Representation. The core idea of object-oriented technology includes objects, classes, encapsulation, and inheritance. Classes, subclasses, and

instances form a hierarchical structure, which supports the classification and representation of knowledge and enables knowledge to be organized in a certain form [6, 7]. Object-oriented knowledge representation is mainly based on abstract data types, which is convenient to represent the static characteristics, real-time state, and interobject association of complex objects.

Because each object has three important parts: inherent attribute, operation behavior, and relationship with other objects, four base classes are established according to the object-oriented idea: attribute class, behavior class, entity class, and relationship class. The conceptual model of object-oriented knowledge representation is shown in Figure 1.

The attribute class is used to represent all the basic attributes of objects, the behavior class is used to represent all the basic behaviors, the relationship class is used to represent all possible relationships between entities, and the entity class is used to represent all objects. Commonly used knowledge representation methods [8] are the following:

(1) Predicate logic representation:

The main knowledge in artificial intelligence is often expressed by first-order predicate logic. Predicate logic representation can express things that cannot be expressed by propositional logic, but it still has some shortcomings for the representation of complex problems.

(2) Production rule representation:

Production rule is a widely used knowledge representation in expert system at present. The knowledge of causality is generally expressed by production. Its basic form is as follows:

IF P THEN Q

in which P is the precondition of the production formula; Q refers to the conclusion or operation obtained when condition P is satisfied. The meaning of the production formula is expressed as follows: if the premise P is satisfied, the conclusion Q can be deduced or the operation specified by Q can be performed.

2.2. Strategy Reasoning Mechanism

2.2.1. Data-Driven Forward Chain Reasoning Algorithm.

According to the existing information of the problem, the context is established by adopting the rule forward. If the condition of the rule can be correlated with the existing facts, the rule is considered to be available. If there are several rules that satisfy the conditions, the conflict resolution strategy is used to select one, and add the fact of the rule to the context [9]; then repeat this process until the problem is solved or reasoning fails. The algorithm is described as follows:

Procedure Forward Reasoning (rulers)

{while (context fact \neq target fact) Do

Call the procedure Select_rulers to generate available rule sets;

While ($R \neq \text{NULL}$) Do

{Call the procedure Conflict _ Resolution (R) to resolve conflicts and generate executable rules; Call Operation _ block to add the conclusion of the rule to the dynamic context; }

}

2.2.2. Goal-Driven Backward Chain Reasoning Algorithm.

By assuming factual goal and searching the knowledge base, the rule set that may match the fact can be found out, and then check the condition part of each rule in the rule set. If a rule can be correlated with the current data provided by the user, add the conclusion part of the rule to the database. Otherwise, take the condition item of the rule as a target, recursively executing the described process until all the subtargets appear in the context or the subtargets are not further solved [10]. For the latter, backtracking recurs again. The algorithm is described as follows:

Procedure Backward Reasoning

Set the initial reasoning goal and set the initial fact DB; Generating an optional rule set R by using the initial target matching rule;

While ($R \neq \text{NULL}$) Do

{Take one in order as an executable rule; Record the condition position of dynamic database and target library; Call the procedure for recursive + backtracking antecedent matching;

IF (each sub-goal in the target library appears in the dynamic DB) THEN

Add to rule base;

}

IF (natural number) output reasoning failed;

Exit.

2.2.3. Framework Reasoning. First, find a description suitable for all current problems, and then use context reasoning of the framework to find the undiscovered facts, and make relevant operations among the factors (Figure 2).

Specific framework reasoning can be divided into static and dynamic. For static framework, static knowledge is used to represent framework, which corresponds to Rule and static fact in production system [11]. Dynamic framework is a dynamic information set generated in the process of framework reasoning, corresponding to Rule_based. This paper adopts the static reasoning framework, and its implementation code is as follows:

Procedure Frame Handler

Set initial information and dynamic framework set; Set the reasoning end flag to False;

While (reasoning end flag = False) Do

Taking out the activated static framework;

{While (current framework \neq NULL) Do

{IF (query reasoning = True)

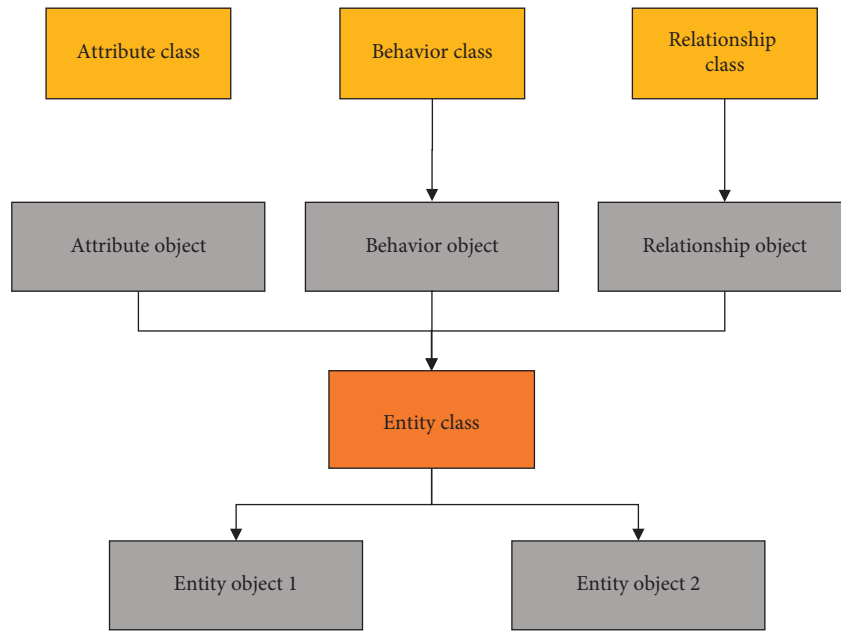


FIGURE 1: Conceptual model of object-oriented knowledge representation.

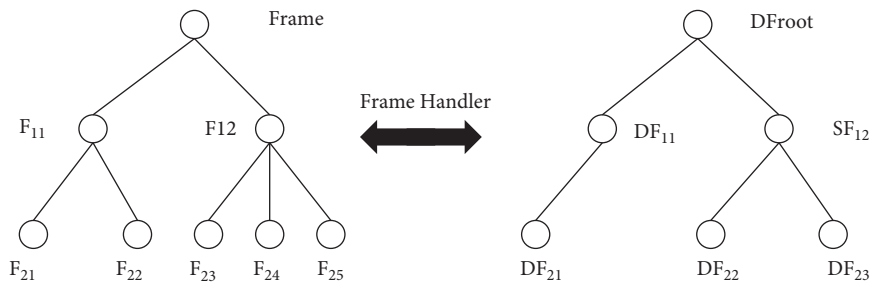


FIGURE 2: Process of framework reasoning.

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{Take the case face value of corresponding factors; goto
A}
IF (default reasoning = True)
{Take the side value of the framework factor; goto A}
IF (inheritance reasoning = True)
{Take the subframe, get the side value of the framework
factor, and call recursively; goto A}
IF (procedural reasoning = True)
{Call the corresponding procedure and get the side
value of the framework factor, goto A}
A: fill in the static framework (or dynamic) corre-
sponding factors of the side value of the factor;
Reset the current static framework;
Set the reasoning end flag False or True (according to
the reasoning situation);
}
}
    
```

2.3. *J2EE Architecture.* Java, often used as one of the back-end development languages of websites, has integrated many convenient frameworks. The system of education and

learning platform is developed by J2EE with the object-oriented characteristics of Java [12, 13]. By combining MVC pattern and related frameworks, distributed architecture and cluster are used to improve the throughput of the system and make its architecture simpler and clearer. To make a dynamic website system, it is necessary to provide a server and database for web applications, so as to analyze and display front-end pages, handle business logic, and read related data.

J2EE architecture reduces the cost and complexity of developing multitier applications by providing a middle-layer integration framework. The middle layer can meet the requirements of high reliability, practicability, and scalability [14]. The unified development platform of J2EE can support the implementation of existing applications and can also fully support Enterprise Java Beans, which enhances the security mechanism and improves its performance [15]. The framework is shown in Figure 3.

2.4. *Lightweight Framework.* Lightweight framework is a programming pattern relative to heavyweight framework (typically EJB) [16]. This is because J2EE platform is a service provided by multiple suppliers, which comprehensively develops enterprise-level application products. On the one hand, the lightweight framework can be developed by simple

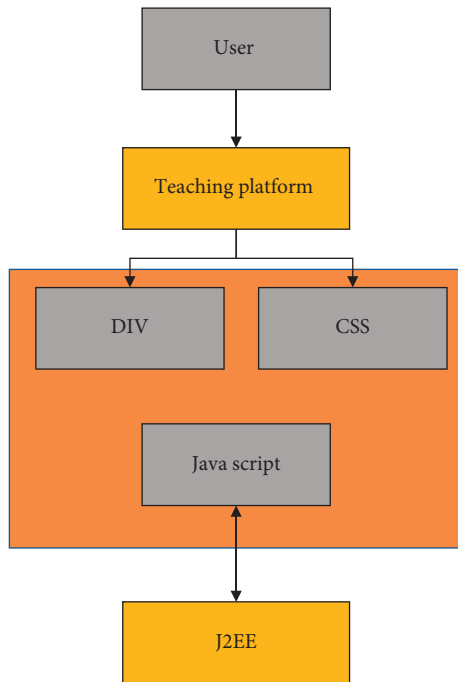


FIGURE 3: Interactive framework of J2EE.

Java Beans method, which can reduce the dependence of applications on containers and improve the development efficiency. On the other hand, most lightweight frameworks belong to open-source projects, and there are a large number of ready-made source codes, which help to reduce the difficulty of developing projects. In addition, lightweight framework has the following advantages [17, 18]:

- (1) Adopt control inversion mode and aspect-oriented programming. It is not necessary to write a lot of code for executing developers, abnormal or managed connections, and it is easy to solve the dependency problem of objects. This not only separates the business logic from the basic framework, but also reduces the complexity and enhances the maintainability of the application.
- (2) Lightweight framework provides management business. Due to its modular attribute, it is not required that business objects must follow the specific interface of the platform. Developers can develop based on POJOs to improve the efficiency.

3. Architecture Design of English Teaching System Based on Strategic Reasoning Mechanism

3.1. Overall Architecture. The systematic architecture is designed as B/S three-layer structure. B/S structure is easier to improve and expand than traditional C/S structure. The C/S structure requires that every terminal client must install the client program; otherwise it cannot work. This limitation makes poor compatibility and universality of the C/S structure [19].

The three-layer model of B/S structure includes the presentation layer (PL), the logic layer (LL), and the data layer (DL). The structural diagram is shown in Figure 4.

The presentation layer, also known as the interaction layer, is the interface between users and the whole system. It provides the user interface of application programs for displaying data and accepting data input by users. The client can run the software only by installing a WEB browser.

The business layer is a WEB server, which realizes the business functions of applications, and almost all business processing is managed in the middle layer. The middle layer is user-oriented, and the information input by the user interacts with the data layer through the middle layer, which mainly processes data business for specific problems [20, 21].

The data layer is a database server with student model and teacher model, while all kinds of data analysis, processing, and other operations ultimately come down to the access to the database in data layer.

Among them, the access between layers is strictly limited, and the logic layer can only access the data layer, while the presentation layer can only access the logic layer. Instead of directly accessing the database, users should connect to the middle layer and interact with the database through the presentation layer [22].

3.2. Functional Architecture. This system includes four kinds of users: experts, teachers, students, and administrators. When users log in, they have different module operation permissions according to different identities.

Expert: Expert refers to a senior English expert who has authoritative and profound knowledge in the field of English major and can thoroughly analyze the knowledge points, degree, and certainty involved in English test questions and give the system samples in the established format. The main permissions include knowledge base maintenance (adding, querying, modifying, and deleting static knowledge base and dynamic knowledge base), sample maintenance (adding, querying, modifying, and deleting), and password modification.

Administrator: they refer to the staffs who have the right to maintain the system daily. The authority mainly includes the management of system users, and the management of question bank includes adding, inquiring, modifying, and deleting.

Teachers: they are English teachers. One or several English teachers are assigned to each course according to the number of students' elective courses. Teachers' rights include viewing students' information, mastering students' learning progress, analyzing the knowledge of designated students or groups, organizing examinations, and analyzing test results.

Students: they refer to the registered students in this system. Their main rights include taking part in online learning in online classroom, self-study, examination, using intelligent analysis or diagnosis system to analyze the knowledge points they have learned, and obtaining relevant suggestions, intensive exercises, personal information modification, etc.

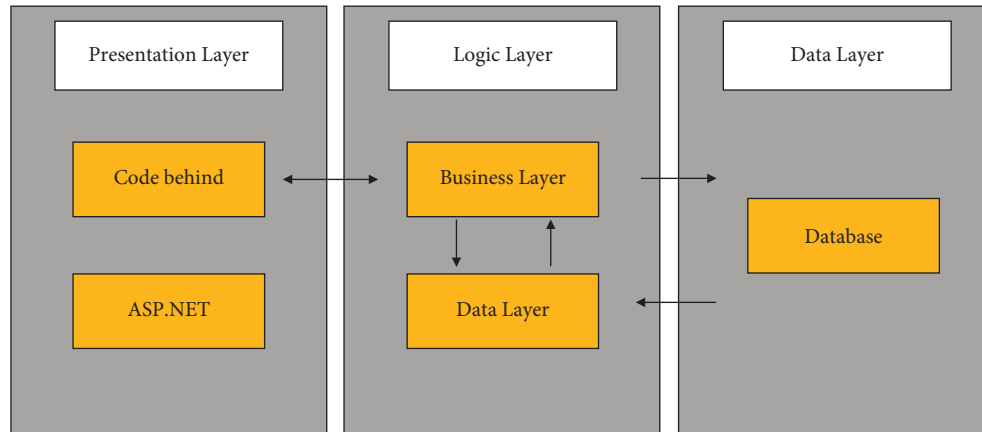


FIGURE 4: B/S architecture.

The system consists of three subsystems, namely, online teaching system, web-based teaching resource database, and teaching management system. The online teaching system is the main system, which mainly provides students with the functions of online real-time receiving and autonomous learning after class. The web-based teaching resource database is the supporting system of the main system, which contains all the resources of teaching and learning, such as courseware, video and audio material database, learning strategy database, corpus, and various teaching resource databases. Students can obtain materials from the resource pool to strengthen or expand their knowledge, while teachers can integrate the materials in the database for teaching or testing.

The online teaching management system is another supporting system, which mainly records, monitors, evaluates, and feeds back the teaching process, including registration module, grading test module, online learning record module, score analysis, and evaluation feedback module. The system manages the students' learning process when they have registered for courses online, analyzes the learners' learning progress, knowledge points, and grades, and establishes corresponding learning files for storage, so as to dynamically track and evaluate the students' learning activities.

4. Systematic English Teaching Mode Based on Strategic Reasoning Mechanism

4.1. Database Design. The data table of the systematic database can be roughly divided into the following types.

User information table: it contains 3 kinds of user information in the system, including user name, password, and user category.

Knowledge point table: it contains all knowledge points of English vocabulary and grammar, including category, name, difficulty level, number, knowledge point association level, and attribute.

Question bank table: its function is to save English test questions provided by experts, including questions, options, and answers.

Rule knowledge base table: it refers to the domain knowledge of experts in the form of rules, including object, object attribute, type, credibility, and fact description.

Strategy base table: the reasoning result descriptions of teaching strategy and learning strategy are saved in this table.

History information table: it is mainly used to save the history of visiting, learning, and practicing of various users.

Analysis table: it includes exercise analysis, knowledge point analysis, learning mastery analysis, and group analysis. It is used to determine feedback results in relevant situations.

4.2. Teaching Process. The traditional teaching mode is generally based on the teacher as the center to educate, while students passively accept knowledge. The Internet-based autonomous learning teaching mode is a new teaching mode with students as the center and teachers playing an auxiliary role. It strengthens students' ability to acquire, process, use, and memorize knowledge, which is of great significance for the learners to understand the research process, improve their quality, and cultivate the awareness of lifelong learning in the cognitive process. The teaching mode of a unit module is shown in Figure 5.

The process is based on the teaching unit as a cycle. For a certain teaching unit, firstly the teaching objectives and learning objectives of the unit are set, and the methods to achieve the objectives are provided. After entering the online class or autonomous learning system, the system provides rich learning resource and forms for students to choose, whether it is the learning of vocabulary and grammar in language knowledge or the learning of listening, speaking, and writing in language skills. It can be a video explanation or a small game of set scene. The next stage is the class training. In this stage, the teacher guides the students in reading, writing, and translation; then, students form a group for interactive training. The fourth stage is the practice, which mainly trains the students' communication skills and improves their relevant abilities by designing a series of activities combined with the social reality which include group discussion on current affairs at home and abroad and filling in the application form for studying

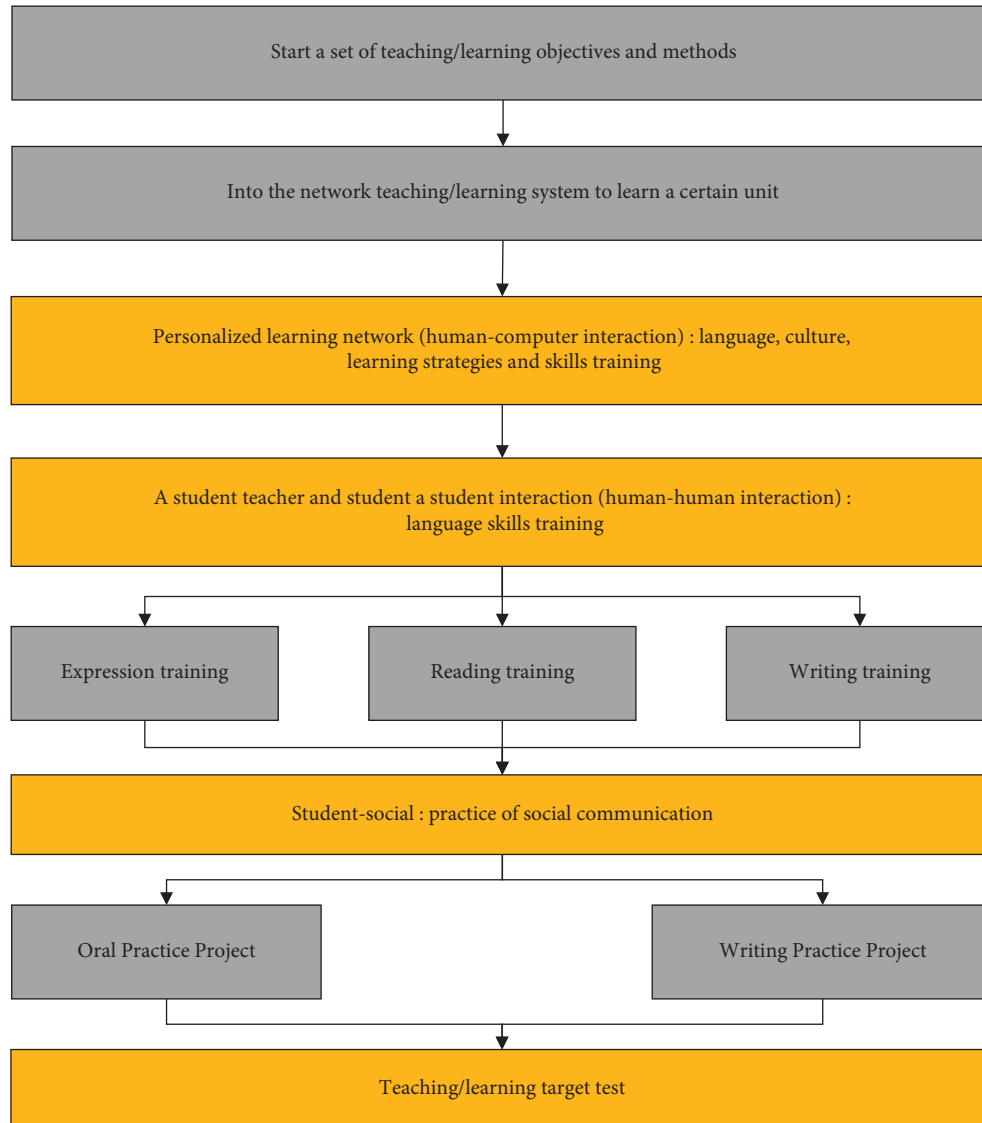


FIGURE 5: Structure of systematic English teaching mode.

abroad. After the completion of the above stages, users will enter the teaching/learning test. If the preset teaching objectives and learning objectives are reached, the cycle will end and users will enter the next cycle. Otherwise, the students will return to restudy according to the mastery of knowledge and skills which contains three kinds of situations: return to communication layer, return to language skill training layer, and return to language learning layer.

4.3. Construction of Knowledge Base. The key point of establishing intelligent teaching mode is the construction of knowledge base, which involves the division of knowledge points. In fact, the basic understanding and memory unit of knowledge concept constitutes the whole teaching content. When learners associate each knowledge unit, the overall structure of the concept can be formed, which is beneficial to understanding and reviewing.

In this teaching mode, the mastery degree of knowledge points is set as 1–6 to quantify the students' understanding of a certain knowledge point, which means that they have mastered, comprehended, understood, not understood, learned, and not learned. The first four are used to describe the degree of mastery of the knowledge point, and the last two are used to judge whether the knowledge point is included in the learning process. When a student first browses a knowledge point, the knowledge point is added to the student's knowledge point model and marked as learned. When they complete a test about the knowledge point, the system will carry out intelligent diagnosis according to the knowledge point and related knowledge points and analyze the students' proficiency level and the causes of errors, thus giving learning suggestions.

The framework of knowledge points judgment in this system is composed of four factors, namely, score, reading capacity, accuracy, and elapsed time. Factor 1, score, refers to the idea that after entering the system, the student first

conducts some knowledge tests within the specified time to roughly understand the overall situation of their mastery of relevant knowledge. The remaining three factors refer to the completion of the students' systematic learning of the knowledge of the unit and the completion of the exercises in the unit. This framework encodes the four factors that determine students' learning level, and the coding order is "S," "R," "C," and "T," while each factor may have multiple values. Infer factor belongs to inheritance reasoning and is a subframe, also known as the lower framework, which is a further logical reasoning of the objective described by the current framework. The lower framework is named according to the infer factor of the upper framework, which can be expressed by production rules.

Taking the judgment that students have mastered the knowledge as an example, the framework rules are as follows:

Rule

Frame name: state decision rule,

Factor 1: score ("very high, more than 90"),

Factor 2: reading capacity ("all, 100%"),

Factor 3: accuracy rate ("very high, above 95% "or" high, 70%–94%"),

Factor 4: elapsed time (less than or equal to "average shortest time"),

Infer factor: judge the learning level of the student as "mastered").

This framework corresponds to different combinations of the values of the four factors and can be simplified to a simple table structure without nesting:

Rule (1, "mastered," [S1, R1, C1/C2, T1]).

Here, "/" is used to indicate the relationship of "or" in the rule. Because the fact and rule of Prolog cannot express the relation of "or" in a clause at the same time, the accuracy rate of answering questions can be one of two cases to split into clauses.

The infer factor corresponds to another framework, which can further evaluate or suggest the student's learning level as "mastered," for example,

Rule

Frame name: learning level is "mastered"

Factor 1: value of level judgment ("excellent"),

Factor 2: value of cognitive ability ("high"),

Factor 3: value of teaching strategy ("enter the next unit").

4.4. Strategy Reasoning Mechanism. Reasoning is a process that starts from the known conditions and gives the corresponding results by querying the relevant rules in the strategy base. According to the characteristics and objectives of the system, the data-driven method is adopted as follows:

- (1) Initialize the rule base and add the known facts into the rule base according to the format required by the system.

- (2) According to the state of the current student model, the known facts (known conditions) are extracted and added to the comprehensive database.
- (3) According to the known facts, the rules existing in the rule base are matched. If contained, execute step 4; otherwise execute step 7.
- (4) Execute the selected rules and marked rules. If necessary, execute the rules; otherwise the conclusion will become new facts and be put into the database.
- (5) Search the comprehensive database. If there is a solution to the problem in the database, it indicates that the problem is solved and the solving process is finished. Otherwise, return to step 3.
- (6) If there are unused rules in the rule base, and they do not match the facts in the comprehensive database, it means that the problem has no solution and the process is terminated.
- (7) If there are no unused rules in the rule base, it means that the problem has no solution and the process is terminated.

If the process of solution fails, it means that the system has not recorded this situation into the comprehensive database. The system should give teaching suggestions according to the student model and basic teaching principles. The basic teaching principle refers to something with obvious regularity in the teaching process [23]. Although it cannot reflect the teaching experience of individual teachers, it is still scientific and effective in accordance with the basic teaching rules. In the process of systematic reasoning, multiple rules may satisfy the conditions. In this case, the priority of rules should be set to resolve the conflict of rules.

5. Conclusion

Implementing research on the innovative teaching mode of college English class in the era of artificial intelligence can catalyze the reform of English teaching. Therefore, in this paper, a teaching mode of English teaching system based on the mechanism of strategic reasoning is proposed. By introducing the idea of artificial intelligence, the student model and the teacher model are designed to separate the teaching content from the teaching strategy. Through the design of system database and teaching process, aiming at the construction of knowledge base, a strategy reasoning mechanism suitable for English teaching is put forward where a lightweight framework is adopted to provide the combination of presentation layer, logic layer, and data layer, which improves the development efficiency. It is a convenient system for transplantation and expansion and has certain practical application value; at the same time, it can provide reference for the design of various teaching systems.

Data Availability

The dataset can be accessed upon request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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References

- [1] L. Xiaofeng and X. Kang, “The status quo of artificial Intelligence and rational thinking of its educational application,” *Modern Educational Technology*, vol. 29, no. 8, p. 12, 2019.
- [2] H. Shihan, “The implementation path of College English flipped classroom in mobile learning environment,” *Journal of Shanxi University of Finance and economics*, vol. 43, no. S2, pp. 164–166, 2021.
- [3] J. Zhou and Z. Lingyun, *From the Essential Characteristics of Computer-Aided Language Teaching, We Can See its Development Process and Development trend Foreign Language Education*, 2010.
- [4] R. H. Bordini, P. M. Fisher, and P. M. Wooldridge, “Verifying multi-agent programs by model checking,” *Autonomous Agents and Multi-Agent Systems*, vol. 2, pp. 19–22, 2006.
- [5] Y. Gu Peter, “Bilingualism as policy: what can we learn from the Hong Kong experience?” in *Proceedings of the First International Conference on Foreign Language Teaching Methodology in China*, pp. 43–59, China, July 2004.
- [6] W. Zhou and J. Huan, “A new object-oriented knowledge representation method,” *Computer Applications*, vol. 32, no. A02, pp. 16–18, 2013.
- [7] W. L. Xu, L. Kuhnert, K. Foster, J. Bronlund, J. Potgieter, and O. Diegel, “Object-oriented knowledge representation and discovery of human chewing behaviours,” *Engineering Applications of Artificial Intelligence*, vol. 20, no. 7, pp. 1000–1012, 2007.
- [8] M. Joshi, R. Khobragade, S. Sarda, U. Deshpande, and S. Mohan, “Object-oriented representation and hierarchical reinforcement learning in infinite mario,” in *Proceedings of the Tools with Artificial Intelligence IEEE International Conference on*, pp. 1076–1081, Athens, Greece, November 2012.
- [9] L. Wang, *Yue Yujun Computer Automatic Reasoning and Intelligent Teaching*, Beijing University of Posts and Telecommunications Press, Beijing, China, 2004.
- [10] W. Wang, *Artificial Intelligence and Its Application*, Higher Education Press, Beijing, China, 2005.
- [11] Zpolate and G. B. Akar, “Automatic detection of learning styles for an e-learning system,” *Computers & Education*, vol. 53, no. 2, pp. 355–367, 2009.
- [12] Q. Xie and X. Chen, “Research on Key Technologies of education learning platform based on J2EE MVC mode,” *Journal of Guangdong Normal University of technology*, vol. 40, no. 6, pp. 89–93, 2019.
- [13] L. Jiang, *Research on Key Technology of Large Scale J2EE System Development*, University of Posts and Telecommunications, Beijing, China, 2008, in Chinese.
- [14] N. E. Ren, C. Dong, and C. Chen, “Research on building high performance web application method based on existing J2EE project,” *Computer knowledge and technology*, vol. 13, no. 32, pp. 76–79, 2017.
- [15] D. Niu and C. M. An, “The design and implementation of financial system Architecture based on J2EE,” *MATEC Web of Conferences*, vol. 44, Article ID 01070, 2016.
- [16] G. Hecht, H. Mili, G. El-Boussaidi et al., “Codifying hidden dependencies in legacy J2EE applications,” in *Proceedings of the 2018 25th Asia-Pacific Software Engineering Conference (APSEC)*, Nara, Japan, December 2018.
- [17] Y. D. Chen, *Application Research Based on J2EE Lightweight Framework* Beijing University of Posts and Telecommunications, Beijing, China, 2010.
- [18] Z. Shuang, “Proficient in STRUTS—JAVA popular server,” *Framework, Tools and Integrated Application*, Posts and Telecommunications Press, Beijing, China, 2007.
- [19] W.-J. Hwang, “A conceptual map model for developing intelligent tutoring systems,” *Computer Education*, vol. 40, no. 3, 2003.
- [20] F. Hong, Y. Hui, and W. Lu, “Knowledge representation model based on error correction diagnosis in ITS,” *Computer Engineering and Applications*, vol. 33, pp. 212–214, 2004.
- [21] H. Shiyuan, Q. Yanhui, H. Qingchun, D. Xinyu, H. Wanjun, and L. Jinglin, “Handbill release system using B/S and C/S hybrid framework,” in *Proceedings of the 2016 Chinese Control and Decision Conference (CCDC)*, Yinchuan, China, May 2016.
- [22] W. Wang, Z. Z. Bian, Y. J. Wu, and Y. L. Miao, *Biomedical and Environmental Sciences Biomedical and Environmental Sciences*, vol. 18, no. 2, pp. 87–95, 2005.
- [23] F. Rongping, “An analysis of English teaching principles under the guidance of cognitive theory,” *Teaching and Management*, vol. 15, pp. 37–40, 2011.