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Research Article

Designing an Intelligent Teaching System of Chinese as a Foreign Language under the Internet Background

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To overcome the limitations of the traditional teaching system and improve learners' language learning efficiency by incorporating personalized allocation of learning resources and learning evaluation into the Chinese as a foreign language teaching system (CFLTS). This paper aims to deeply study the overall design of the intelligent teaching system (ITS) for CFLTS. Firstly, this paper develops an ITS for CFLTS. It focuses on the intelligence teaching system's structural planning and structural design. The system functional structure and the specific characteristics and recommendations module constitute a two-way teaching quality evaluation module. The elite teaching optimization algorithm based on the feedback mechanism is adopted. The students are divided into excellent and poor students after the feedback mechanism is added to split the student stage. Next, they dynamically adjust the scale of excellent and poor students, conduct feedback communication between poor students and teachers, and strengthen the convergence ability. Finally, self-learning for good students is arranged by performing an excellent local search and including the feedback stage to broaden the range of learning methods and improve the ability to find global teaching resources. The completion of all these steps ensures that the design of an ITS for CFLTS is now complete. According to the experimental results, the ITS proposed in this work has a higher level of overall stability, effectively improves students' learning efficiency and teaching quality, and can better meet the needs of Chinese language learners.

1. Introduction

The Internet must assess established communication channels and instructional techniques from the perception of teaching training. Change roles and concepts, arrange unstructured oral Chinese teaching resources, and naturally merge contemporary knowledge with traditional language teaching techniques [1]. To regulate the learning process, teachers must be able to build the learning process utilizing network Internet resources to have each student's learning material through the network. Intelligent computer-assisted educational reforms are the result of a collaboration between pedagogy, psychology, computer science, behavioral science, and artificial intelligence (AI) [2]. The study's ultimate purpose is to empower the computer system to do suitable educational and instructional activities, that is, to add intelligence to the software system so that it can incompletely change teachers and deliver the best possible instruction. [3]. The accessibility of modern digital education in this country surely increases the number of learning environments available for CLT. The public appears to be fetching even further involved in Internet education, which has resulted in the development of more integration and interaction technologies. Due to the increasingly complex characteristics and spatially and temporally separated nature of the Internet backbone education atmosphere, management and teachers are finding it difficult to acquire effective learning data from online students [4].

As a result, there is a one-sided search for quantity and size in the pushing mode of educational materials and simple replication of textbook contents of resources. Implementing a system to collect accurate education information and updates and provide individualized learning services for such a large number of online learners has become a critical challenge [5]. In the context of the Internet, with the gradual popularization of computers and different types of mobile intelligent terminals, the intelligent teaching system with learners as the main body is gradually loved by learners,

which has an impact and changed foreign language teaching methods to a certain extent. Because of the development of economic growth and the significant growth of international commerce, the number of individuals studying Chinese as a second language is steadily increasing [6]. Due to a serious lack of CFLT, improving the teaching quality and learning efficiency of CFL through automation has emerged as the most essential problem to be addressed. The rapid development of information technologies in the twenty-first century provides an excellent opportunity for the creation and implementation of an intelligent teaching system for CFL.

Domestic research and development of intelligent teaching systems for Chinese as a foreign language have evolved in recent years, with some results, as artificial intelligence technology has matured. Li and Wang evaluated the rapid expansion of artificial intelligence and its widespread use in many areas of society, summarizing the practical demands of Chinese as a foreign language intelligent conversation and conversation system. The study's findings have been utilized to investigate the system structure and notion of Chinese as a foreign language both at home and abroad. The intelligent learning system is based on chat robots and takes situational learning theory, constructive learning theory, and artificial intelligence natural language processing technology as guidance. Make sentence word segmentation and calculation based on a vector space model to complete the similarity matching of Chinese sentence semantics and use the TF-IDF algorithm to match keywords. The target is to realize the automatic questions and answers by establishing a chat robot based on artifical templates and rules; then, the datailed unique functions and specific effects of the application practice will be introduced. The implementation of the intelligent system for teaching Chinese as a foreign language is now in progress. Due to the complexity of the process, the teaching quality has not been effectively improved [7]. The rapid development of artificial intelligence technologies in recent years has been proposed by Hua and He. Natural language understanding and processing technology have become the primary focus of the integration of artificial intelligence and linguistics. A highly interactive intelligent teaching system is designed based on Internet NLU and NLP technology, as well as the characteristics of CFL. Using pre-existing intelligent teaching equipment, the intelligent teaching system creates an intelligent teaching environment, writes teaching cases, and establishes a multidirectional teaching assessment system. By applying the designed teaching system scientifically to teaching Chinese as a foreign language, promoting fundamental changes in teaching forms, and providing effective assistance for the establishment of learners' learning environments and personalized learning, the establishment of a new intelligent teaching system has altered the relationship between teachers and students, but this method does not improve learning efficiency [8]. This study aims at the problem of the slow response time of traditional teaching systems and designs an intelligent teaching system for a foreign language. Under big data, the hardware part of the system uses a CCD device to design the sensor, which is connected to the laser feedback device and uses a dual-core processor. The device uses multitouch technology to design the high-definition touch interactive mirror device and connects the mirror device to the camera to form a touch platform. Big data technology is used to deal with the specific situation of students' knowledge; a Bayesian formula is used to summarize the teaching data; and Java programming is used as an input. So the teaching data is needed to comprehensive the software design of an intelligent teaching system. As compared to previous intelligent teaching systems, the experimental results show that the system reaction time in practical operation is substantially improved, but students' overall learning efficiency is inadequate [9].

The perspective of learning subjects, the intelligent CFLTS, and the Internet can support students to overcome barriers. When learners encounter problems while learning Chinese, the ITS provides timely and modified guidance based on learning time, learning space, teachers, and curriculum. The ability of educators to use and develop intelligent teaching systems and also teachers' professional quality is highly dependent on new technology. The existing intelligent teaching method for Chinese as a foreign language, according to the results, has a limited applicability level. The original ideas, particularly in the area of intelligent design, must be improved to improved meeting the requirements of modified and autonomous learning.

The following are the paper innovations:

(i) Firstly, the elite teaching optimization algorithm based on the feedback mechanism is used to develop an intelligent teaching system for Chinese as a foreign language

(ii) Secondly, the student stage is carried out, the feedback mechanism is added to divide the students into excellent students and poor students, and the scale of excellent students and poor students is dynamically adjusted

(iii) Thirdly, the feedback stage is added to the development of the diversity of education methods and improves the ability to search for global teaching resources

(iv) Finally, the overall stability of the intelligent teaching system of Chinese as a foreign language designed in this study is highly efficient as compared to the traditional teaching system, and it can effectively increase students' learning efficiency and teaching quality

The rest of this paper is organized as follows: Section 2 shows related work; Section 3 shows the design of an intelligent teaching system for Chinese as a foreign language; Section 4 shows the optimization algorithm for elite teaching CFLT based on the feedback mechanism; Section 5 shows the analysis and experimental results; and finally, in Section 6, the research work is concluded.

2. Related Work

The literature aims to assemble a huge number of resources on the Internet, and the information resources are easily categorized together, resulting in the phenomenon of data information islands, which leads to a poor sharing effect of teaching and waste of teaching resources. Therefore, Ma JC introduced a multinetwork ITS for CFL and shared teaching resource data using the logic control center. The logic control center's

resource sharing module, for example, uses a structured peer-to-peer network. The query, positioning, and sharing of intelligent teaching resources for CFL are completed through mutual communication between the node and the execution node. After the classroom subcontrol switches the signal, the system's control module sends it to the centralized teaching control. As a result, data and communication management must be realized. The teaching system employs the multinode network algorithm to select the node with the smallest variance value as the outlet to ensure the remaining load capacity of the shared network node. The system is strong and effectively transmits teaching resources for intelligent teaching. The intelligent teaching system's network swallowing volume is substantially higher than the comparison system's, yet the system does not influence the quality of teaching CFL, according to the experiment [10]. According to the authors of this study, the current network teaching platform includes a wide range of learning resources, and each platform focuses on developing students' skills in specific areas rather than creating an overall capacity for writing, listening, reading, and speaking [11]. In the author's design, modern information technology and traditional language training methodologies are seamlessly integrated. To regulate the learning process, teachers should be able to create the learning process using network resources and obtain each learning and teaching relevant information [12]. The authors of the study created a student model that is in charge of representing students' knowledge level, learning style, cognitive capacity, education olden times modification, learning motivation, and further data systematically [13]. These problems in the present Chinese language network teaching platform, proposed in this study, must be easily resolved, and it is vital to establish a complete, interactive, personalized, and feedback-capable CLT platform [14]. The authors of this study present the primary characteristics of a network teaching platform to display students' characteristics and attitudes and to provide a framework for the development of intelligent teaching objectives, educational resources, and teaching methods [15]. According to the literature, teaching practices must encompass cognitive ability, motor skills, and emotions, with cognitive ability objectives separated into six categories based on the difficulty of intellectual activity [16]. The author of this paper suggested a design for an intelligent network teaching system. This author's purpose is to develop a Chinese language teaching system approach based on DL, based on previous research and the current condition of the Chinese language network teaching system. It also categorizes students' learning styles and offers alternative teaching tactics and materials based on their preferences. The approach may create a customized environment for learning depending on the characteristics of learners in real time, allowing for truly individualized instruction [17].

3. Development of an Intelligent Chinese as a Foreign Language Teaching System

3.1. Intelligent Teaching System Structure Designed for Chinese as a Foreign Language. Figure 1 shows the ITS structure planning for Chinese as a foreign language:

(1) The user interface for the system structure is simple and clear, generous, and attractive. It supports the intelligent navigation feature and can operate and retrieve in more ways.

(2) Create a social framework for teaching methods.

(3) Improve the intelligence of the intelligent teaching system through natural language processing technology and hypermedia technology [18, 19].

3.2. The Functional Structure Design of an Intelligent Teaching System (ITS). Figure 2 shows the functional structure design of the ITS. The intelligent teaching system for Chinese as a foreign language mainly adopts the structure of the multilayer system, including four layers, specifically the client and content layer, and also the service layer and data layer.

3.2.1. Client. It specifically includes administrators, teachers, and students, which are accessed by a browser, while the server is collected of a content layer, data layer, and service layer [20, 21].

3.2.2. Content Layer. The specific function is similar to the navigation home page. It is provided to the client based on the user's personalized interface and the intelligent teaching system's teaching content. Other modules in the intelligent teaching system need to use the navigation home page to enter the navigation page of the system. When entering the navigation page, they need to pass the identity authentication; otherwise, they cannot enter the teaching system page.

3.2.3. Service Layer. The application service layer and the public service layer are two types of service layers. Teaching functions are provided by the application service layer, which is divided into communication and learning modules. The TCFL system relies heavily on the learning module. Users communicate in a variety of ways, one of which is through communication. The application service layer is the teaching function layer in the ITS system of CFL [22, 23].

3.2.4. Data Layer. The specific function is to save the received teaching resource data, including four modules: archives of learning CFL, learning planning and problem-solving database, and teaching resource database. The specific function of the archive's module of learning CFL is to record the knowledge level mastered after learning in the ITS, and it is also the main source of screening personalized information.

In the ITS of CFL, multiple modules such as the client and content layer, service layer, and data layer cooperate to complete intelligent teaching. Pronunciation and vocabulary, grammar, and Chinese characters are all taught as language elements in the ITS of CFL. Table 1 shows the analysis of specific features.

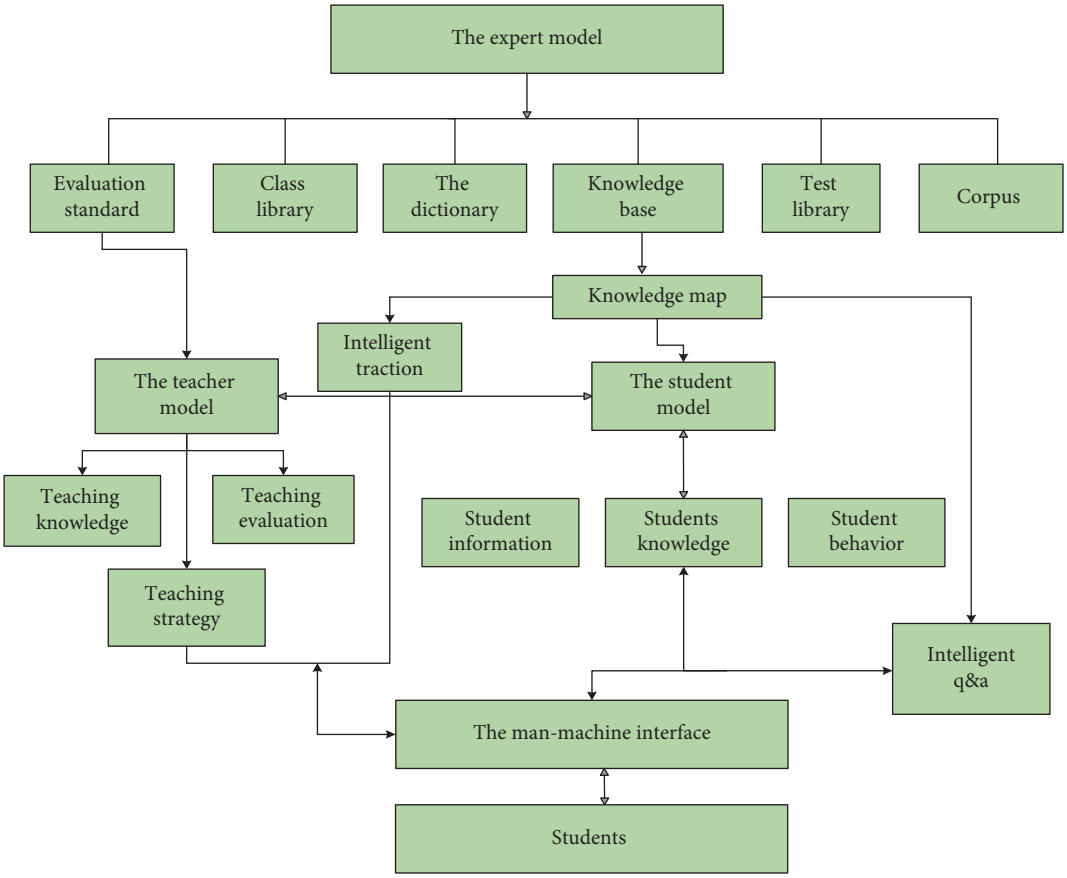

Figure 1: Basic diagram of TCSL lexical structure planning.

3.3. Recommendation Module in the ITS. In an ITS, the recommendation module has three parts: it generates user characteristics, matches the information, and generates recommendations. Collect the user's use demand, interest demand, and other data and calculate the data for teaching CFL using the appropriate technology. The results are shown as in Figure 3.

In Figure 3, the recommendation module in the ITS of CFL is divided into three steps:

(1) Convert the user's behavioral characteristics into user data and then generate feature vectors

(2) According to the different categories of user data and the selected corresponding structure, they choose the data similar to the user's feature vector and then generate the data table to complete the data recommendation of teaching resources

(3) Make statistics and arrange the recommended results analyzed in step (2) to complete the recommendation [24, 25]

3.4. Two-Way Evaluation Module for Teaching CFL. As shown in Figure 4, the two-way evaluation module has good usability and interactivity and can perform functions such as intelligent attendance, classroom discipline monitoring, and feedback on teaching results. Figure 4 shows a teacher terminal, an educational terminal, a student terminal, and a classroom terminal connected to a cloud server via mobile network communication. Classroom terminal data collection is an image processing technology that uses the camera for frame processing. The system uses a detection model of an image target and a face detection model to identify and analyze the collected data, allowing timely updates of stored data and feedback data. The terminal of a classroom is mainly set up in the classroom, which consists of four units: the processing unit, the data collection unit, the terminal management unit, and the network communication unit. The client consists of a classroom terminal and a teaching terminal and consists of three functions: sending, receiving, and displaying [26, 27].

4. Optimization Algorithm for Elite Teaching of CFL Based on the Feedback Mechanism

The elite teaching optimization algorithm of the feedback mechanism takes the population as the whole class. The optimal individual in the population is the teacher. So, to realize the optimization evolution, the teacher improves the average score of the class by carrying out teaching activities. The ultimate purpose is to improve their academic performances and promote the absorption of CFL knowledge [28, 29].

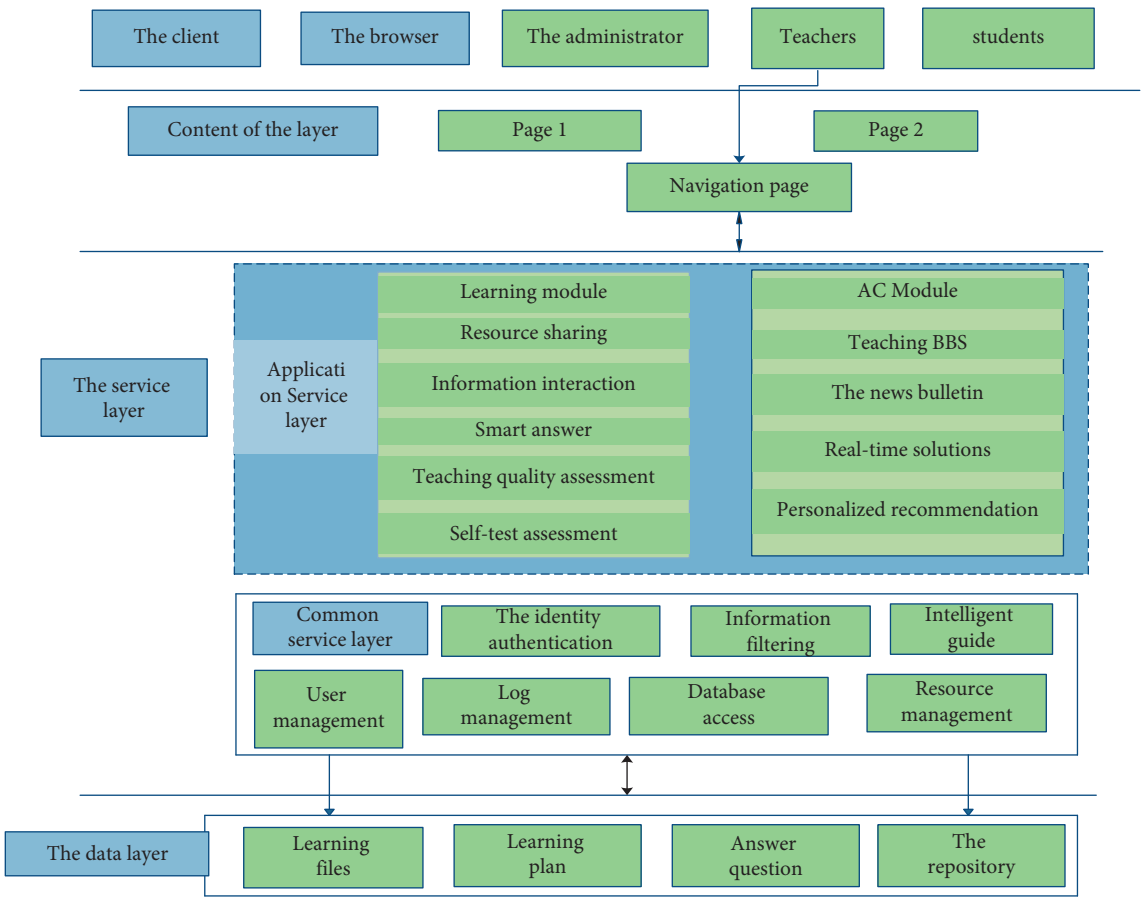

Figure 2: System functional structure design framework.

Table 1: Analysis of characteristics of ITS of CFL.

Category	The name of the system	The main advantages	Main drawback
Voice	Pinyin Trainer Android/IOS	Consonant, vowel, combination, and tone pronunciation	Teaching is not combined with Chinese characters
	Pinyin phonetic iOS	Initial, final, combined, and tetra tonic sounds	Teaching is not combined with Chinese characters
Vocabulary	Pleco Chinese Dictionary IOS	Rich entries and examples Entries updated in time	Not integrated with vocabulary teaching strategies
	Train Chinese Android/IOS	Vocabulary is classified by situation and HSK level	Vocabulary not accompanied by pictures, audio, and video
Chinese characters	Chinese writer Android/IOS	Chinese characters are classified according to HSK level	The structural meaning of Chinese characters is not explained with pictures, audio, and video

4.1. Teacher Stage. The teacher stage simulates the process of teaching CFL as the best individual in the population is the teacher. The ITS of CFL teachers helps students improve their academic performance to improve the comprehensive level of the class. In the number i of any iteration, the amount of public in the CFL class is n. The average value of academic performance is M_i, and the teaching CFL teacher is T_i. The Chinese foreign language teacher T tries to make the average value of academic performance M closer to his own level. Therefore, the new average value of academic performance M_{new} is close to T_i. The difference between the current average value of academic performance in a foreign language and the new average value is expressed by the following formula:

$$\text{Difference\_Mean}_i = r_i\left(M_{\text{new}} - T_f M_i\right), \tag{1}$$

where r_i represents the random number between 0 and 1 and T_f represents the teaching factor. Teaching the CFL system plays a decisive role in the change degree of the average value of academic performance. T_f and publicity (2) are determined as follows:

$$T_f = \text{round}\left[1 + \text{rand}\left(0, 1\right)\right]. \tag{2}$$

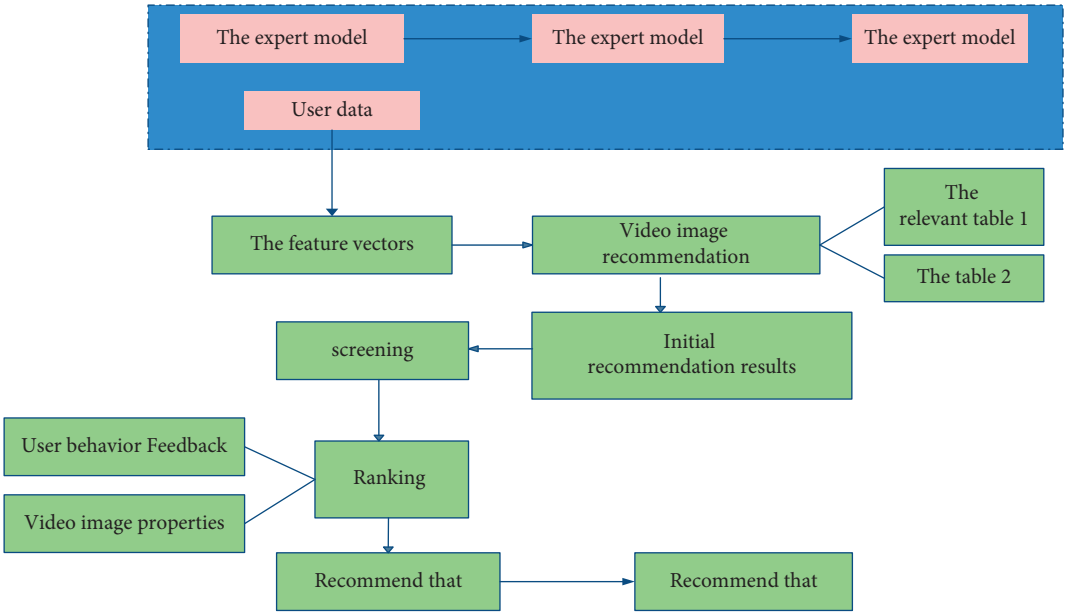

Figure 3: Big data personalized recommendation module.

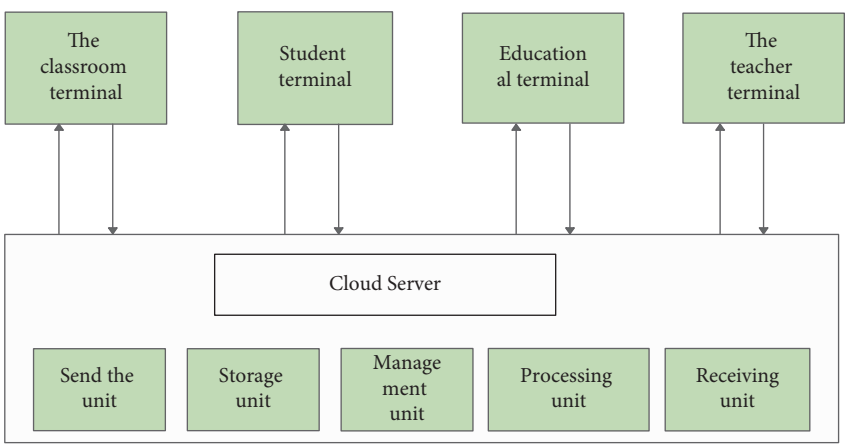

Figure 4: Bidirectional assessment module of intelligent teaching quality.

The teacher phase updates the present solution according to the following formula:

$$x_{\text{new},i} = x_{\text{old},i} + \text{Difference\_Mean}_i. \quad (3)$$

In equation (3), if x_{new} is better than x_{old}, x_{newis} retained; otherwise, x_{new} is discarded.

4.2. Student Stage. Generally speaking, Chinese as foreign language students need to adopt two ways to improve their academic performance. They are learning CFL through teachers' teaching and acquiring knowledge of Chinese as a foreign language through mutual communication among students. The student phase is a method in which students learn from one another to enhance their knowledge level [30, 31]. If the teaching problem to be solved is the minimum value problem, let x be the independent variable and $f(x)$ represent the objective function of the teaching optimization problem. After the teacher stage, randomly select two different students x_i and x_h and use the comparison of the corresponding function value of the students. If $f(x_i) \leq f(x_h)$, it means that the student x_i is better than x_h. Therefore, x_{new} gradually approaches x_i; otherwise, the students x_h is better than the student x_i, and x_{new} gradually approaches x_h. The update formula is represented by the following formulas:

$$f(x_i) \prec f(x_h), x_{\text{new},i} = x_{\text{old},i} + \text{rand}_i(x_i - x_h), \quad (4)$$

$$f(x_h) \prec f(x_i), x_{\text{new},i} = x_{\text{old},i} + \text{rand}_i(x_h - x_i). \quad (5)$$

Compare the efficiency value of the new solution after the student phase x_{new} with that of the current solution x_{old}. If $f(x_{\text{new}}) \prec f(x_{\text{old}})$, x_{new} can be accepted; otherwise, x_{new} will be abandoned.

An elite teaching algorithm of TCFL based on a feedback mechanism is proposed. The feedback process is to calculate

the students' scores after the student stage. The fitness value is $f(x_i)$ compared with the average grade f_{Mean} of the class; the class students are divided into excellent students and poor students [32, 33]. Students with poor academic performance must actively engage in feedback and communication with teachers, as well as strengthen their weak knowledge areas. However, to improve the learning levels of students with excellent academic performance, the knowledge of CFL obtained from teachers is limited. The way to obtain knowledge depends on independent education to improve their learning performance in this procedure.

Add a coefficient to the usual performance of learning CFL λ. There is a correlation between the coefficient and the number of iterations, which makes the top students learning CFL increase dynamically with the increase of the number of iterations. The coefficient position is represented by the following formula:

$$\lambda = \frac{i_{\max}}{i_{\max}}, \tag{6}$$

where i represents the number of present iterations and $i_{\max}$ represents the number of maximum iterations. λf_{Mean} is the criterion to distinguish excellent students from poor students in learning Chinese as a foreign language.

It can be realized from the above contents that the feedback mechanism is described in detail as follows: after the student phase, the suitability value $f(x_i)$ of the student is calculated and compared with the judgment standard λf_{Mean}. If $f(x_i) > \lambda f_{\text{Mean}}$, it is a poor student. It communicates with the teacher and gives feedback, which is shown by formula (7). On the contrary, it is a top student. It carries out self-learning feedback and adds small probability variation events, which are expressed by formulas (8) and (9).

$$f(x_i) > \lambda f_{\text{Mean}}, x_{\text{new},i} = x_{\text{old},i} + \text{rand}_i (x_{\text{teacher}} - x_i), \tag{7}$$

$$f(x_i) < \lambda f_{\text{Mean}}, \quad \text{rand} > M_r,\ x_{\text{new},i} = x_{\text{old},i} + \text{rand} \cdot \left(\frac{i}{i_{\max}^{U^L}}\right), \tag{8}$$

$$f(x_i) < \lambda f_{\text{Mean}}, \quad \text{rand} < M_r,\ x_{\text{new},i} = x^L + \text{rand} \cdot \left(x^U - x^L\right), \tag{9}$$

where M_r represents the random variation probability, and the value in this paper is 0.05; x^U represents the solutions space's upper bound; and x^L represents the lower bound of the solution space.

After adding the feedback phase, associate the suitability value between the novel solution x_{new} and the present solution x_{old}. If x_{new} is better than x_{old}, x_{new} is accepted. After joining the Internet, the student's ability to learn Chinese as a foreign language is improved. The ability of students to learn CFL is improved by combining the diversity of algorithm design with the background of CFL.

Table 2: Environment for experimentation.

The test environment	Data
Server version	Tomcat 6.0
Background database	MS SQL Server 2000
Client running environment	Windows 2003
CPU	2 × 2.6 GHz
System memory	2G
Testing tools	Load Runner 7.8

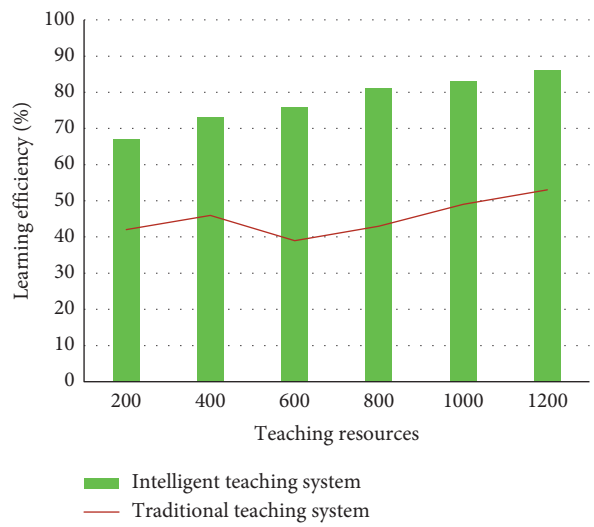

Figure 5: Comparison of the improvement of learning efficiency of different systems.

Table 3: Comparison of time consumed by 500 iterations of the test function.

Different teaching methods	Time (s)
Feedback mechanisms for elite teaching	7.812
The traditional teaching	9.135

5. Analysis and Experimental Result

Experiments are being carried out to test the performance of the intelligent CFLTS in an Internet environment. The environment for experimentation is depicted in Table 2.

Figure 5 shows the comparison of learning efficiency between the intelligent teaching system of CFL and traditional teaching.

Figure 5 shows that the learning efficiency of the ITS of CFL suggest in this work is comparatively high in the early stages of teaching resource learning. Learning efficiency improves over time as teaching resources increase, whereas in the early stages of the experiment, improvements in the learning efficiency of the traditional teaching system are not readily apparent. When teaching resources are increased to 600, they decrease and then increase, indicating that overall learning efficiency is low and that there are still some fluctuations. This shows that the ITS for CFL used in this paper can significantly improve the efficiency of students' learning after 500 iterations. Table 3 compares the elite teaching optimization algorithm proposed to the traditional teaching optimization algorithm in terms of time.

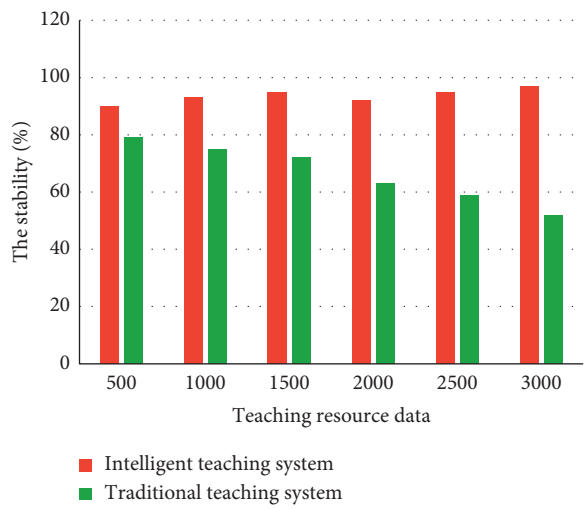

Figure 6: Comparison of stability of different teaching systems.

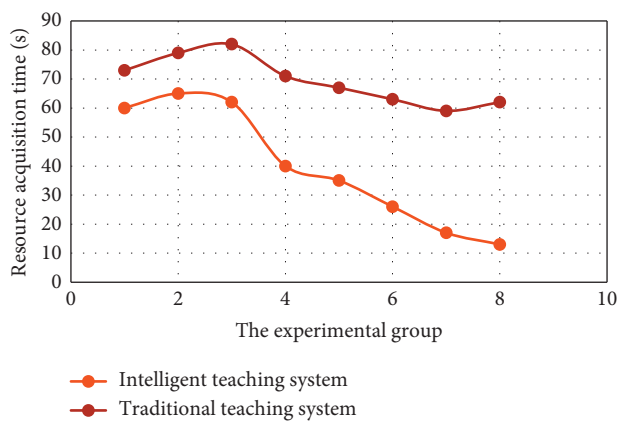

Figure 7: Time comparison of acquisition of teaching resource data by different systems.

Table 3 shows that the elite teaching optimization technique proposed in this paper, which is based on a feedback mechanism, can quickly converge near the value's optimal solution. The 500-iteration time is faster than the traditional teaching optimization algorithm, allowing it to overcome the constraints imposed by the local optimal extreme value and improve. The solution's accuracy improves as the convergence speed increases. Figure 6 depicts a stable comparison between the intelligent CFLTS proposed in this paper and the traditional CFLTS.

As shown in Figure 6, the overall stability of the ITS designed in this paper for CFL is significantly higher than that of the traditional teaching system. The stability of the traditional teaching system is relatively high during the initial operation of the system but decreases as teaching resources are gradually increased. The constancy of the traditional teaching system gradually decreases, while the stability of the ITS designed in this paper achieves 90% of the initial experiment. The system stability has been maintained at more than 90% due to the gradual increase of teaching resource data. This demonstrates that the intelligent CFLTS proposed in this paper has strong performance and can effectively improve teaching quality. Figure 7 depicts a time comparison of the intelligent teaching system and the traditional teaching system, which were divided into eight groups to obtain data on teaching CFL resources.

Figure 7 shows that at the start of the experiment, the time difference between the ITS and the other was significant. The traditional teaching system for obtaining CFL teaching resources is relatively small. However, as a result of each group's experiments, the time it takes for the traditional teaching system to obtain teaching resources for CFL is gradually reduced. The time it takes to obtain teaching resources data for the ITS of CFL proposed in this paper gradually decreases. The shortest time to get teaching data on CFL is 12 seconds. This demonstrates that the ITS proposed in this paper can efficiently improve student learning efficiency and teaching quality.

6. Conclusions

In the present educational improvement environment, the Chinese ITS is becoming progressively essential as a foreign system. In China, there have been few achievements in this area and even limited technology that can be utilized in the classroom. This area, which has a lot of potential for expansion, deserves more examination and discussion. Further education is needed to better understand the mechanisms that impact learning since the process of learning and the variables that complement it are all so numerous and intricate. As a result, process improvement is a must. Learning event categorization, documentation, and assessment approaches are a complex interaction of educational activities, student characteristics, and instructional methodologies. The demand for a scientifically designed and fully functional ITS for CFL is gradually increasing as the number of Chinese learners grows and intelligent mobile terminals become more popular. As a result, this paper proposes an intelligent CLTS, which takes into account the systematicity of Chinese as a second language, learning characteristics, and teaching strategies, as well as learner needs, in order to conduct an in-depth study on the design of an efficient is intelligent CLTS. The proposed internet-based CLTS model can alter students' learning methods. Those who assess students' learning levels, skills, learning styles, and other student status and characteristics and provide data for teaching and expert modules. Simultaneously, allowing it to provide personalized learning resources and environments for students improves the intelligence of the CFL and ITS. Educating students according to their abilities is highly practical.

Data Availability

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

Conflicts of Interest

The author declares that there are no conflicts of interest for the publication of this paper.

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