Design Study on Integrated Application System for College Foreign Language Teaching under Blended Learning Mode

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Abstract: This study designs an integrated application system for college foreign language teaching in a blended learning environment. The system follows the principles of student-centered design, teacher-led reinforcement, resource sharing, modularization, and standardization. It encompasses a knowledge base, interactive platform, component library, Q&A community, and intelligent assistance module. The system supports resource development, teaching interaction, component reuse, Q&A exchange, and intelligent support. Through comparative experiments with traditional face-to-face teaching, it was found that the application of this system in blended teaching can improve students' learning attitudes, academic performance, and language abilities. The study indicates that the system can effectively enhance the quality of foreign language teaching.

Keywords: Blended Learning; Foreign Language Teaching; System Design; Interactive Platform; Intelligent Support

1 Introduction

With the continuous development of information technology, blended learning has gradually become the mainstream mode of college foreign language teaching. How to leverage information technology to improve the quality of foreign language teaching in a blended environment is a pressing issue [1]. This study aims to design an integrated application system for college foreign language teaching, optimizing the blended teaching process and enhancing learning outcomes through building a knowledge base, interactive platform, and providing intelligent support. The development of this system has significant implications for advancing the informatization of foreign language education [2].
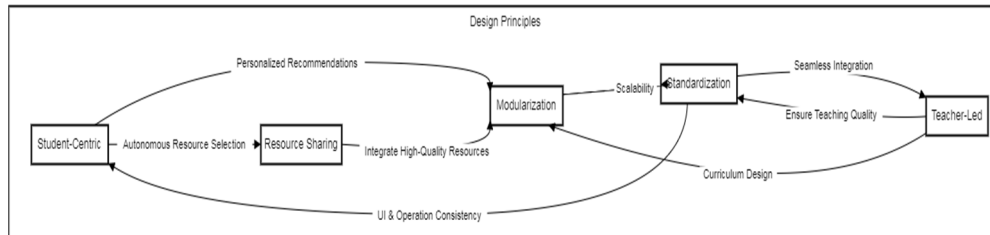
2 System Design

2.1 General Design Philosophy

2.1.1 Design Principles

The system adheres to five major principles: Student-Centric, Teacher-Led, Resource Sharing, Modularization, and Standardization[3]. Specifically, the system: (1) offers a personalized

learning experience, recommends learning content, and provides a variety of learning resources; (2) emphasizes the role of teachers in knowledge transmission, supporting video explanations and assignment settings; (3) integrates high-quality resources for sharing; (4) adopts a modular design to enhance scalability; (5) ensures the standardization of interfaces and functions to optimize user experience[4]. The detailed design principles are illustrated in Figure 1.

Figure 1: Diagram of Design Principles

2.1.2 System Composition

The system is composed of five modules: Knowledge Base, Interactive Platform, Component Library, Q&A Community, and Intelligent Assistance Module. Specifically, the Knowledge Base stores multiformat foreign language learning resources; the Interactive Platform supports teacher instruction and interaction between teachers and students, such as video teaching and homework assignment; the Component Library provides basic functions, like voice interaction and text processing; the Q&A Community offers an open platform for students to ask questions, discuss, and exchange knowledge; the Intelligent Assistance Module utilizes AI technology to provide support like automatic grading, writing revision, and translation. The specific system composition is illustrated in Figure 2.
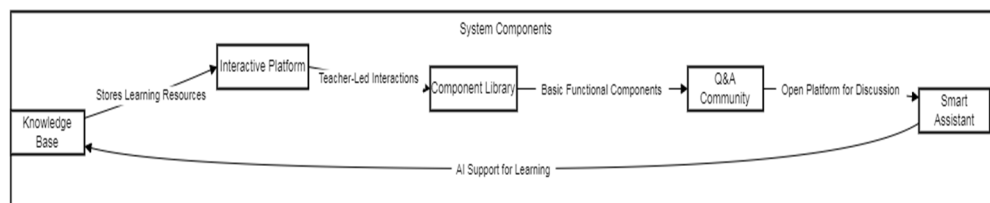
Figure 2: System Composition Diagram

These subsystems work together to form a fully functional and user-friendly foreign language teaching system. The design of the system takes into account various needs including learning outcomes, teaching efficiency, and resource utilization [5].

2.2 System Functional Module Design

2.2.1 Knowledge Base

The knowledge base is the core of the system, centrally managing various foreign language learning resources such as text, images, audio, and video. Resources are labeled according to

language and difficulty level, supporting personalized recommendations and continuous assessment to ensure resource availability and quality [6]. Students can retrieve materials suitable for their level, and provide evaluations and feedback. Overall, the knowledge base plays a key role in resource storage, management, and personalized recommendation, aiming to provide a high-quality learning experience [7].

2.2.2 Interactive Platform

The interactive platform serves as the core of teaching and communication within the system, supporting teachers in releasing teaching syllabi, organizing activities, conducting video teaching, and assigning homework [8]. Students can autonomously plan their learning, watch videos, participate in discussions, and engage in team projects. This platform is closely integrated with the knowledge base, allowing teachers to directly access resources. Overall, the interactive platform enhances interaction between teachers and students as well as among students, optimizes the learning experience, and supports various innovative learning methods [9].

2.2.3 Component Library

The component library integrates various basic functions for foreign language learning, such as voice input and output, evaluation, text recognition, and human-computer interaction, all using a common interface, supporting secondary development and customization. Teachers can directly invoke suitable components to quickly organize teaching activities without the need for complex programming [10]. Overall, the component library simplifies teaching design, improves work efficiency, and supports diverse and efficient teaching methods.

2.2.4 Q&A Community

The Q&A community is an open, interactive platform, allowing users to ask questions, engage in discussions, and answer foreign language learning queries. Good questions and answers can be integrated into the knowledge base. The community also features intelligent clustering analysis, automatically organizing and categorizing questions to form learning manuals. This not only promotes interaction among users but also helps teachers better understand student needs, while enriching the system's knowledge base. Overall, the Q&A community provides a collaborative and co-learning environment for foreign language learning.

2.2.5 Intelligent Assistance Module

The intelligent assistance module applies AI technology, offering functionalities like automatic voice evaluation, writing checking, text translation, and grammar correction. Based on deep learning models, these functions are closely integrated with the knowledge base and interactive platform, delivering personalized intelligent support. For instance, students can directly use the writing check function after composing. This not only enhances students' learning experience but also reduces the workload for teachers. Overall, this module realizes intelligent and personalized support for foreign language learning.

The complete system functional module design is shown in Figure 3:
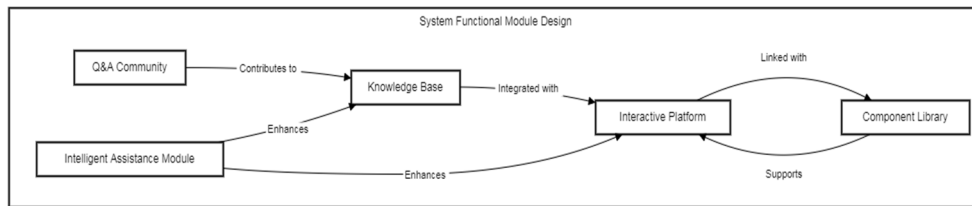
Figure 3: System Functional Module Design Diagram.

Description of the System Functional Module Design Diagram:

In the design diagram, we primarily showcase the following functional modules:

Knowledge Base: This is the core part of the system and is associated with other modules. It centralizes the management of various foreign language learning resources.

Interactive Platform: As the educational communication core of the system, it has a close connection with the Knowledge Base and the Component Library. It supports teachers in publishing educational content and interacting with students.

Component Library: This provides basic functionalities for foreign language learning and can support the features of the Interactive Platform.

Q&A Community: An open interactive platform where quality content can be integrated into the Knowledge Base.

Intelligent Assistance Module: Utilizing AI technology, it is closely integrated with the Knowledge Base and Interactive Platform, providing personalized intelligent support.

In terms of relationships, the Interactive Platform has direct connections with both the Knowledge Base and Component Library; the Component Library also provides feature support for the Interactive Platform; the Q&A Community contributes content to the Knowledge Base; and the Intelligent Assistance Module enhances the functionalities of both the Knowledge Base and the Interactive Platform.

2.3 System Architecture Design

2.3.1 Overall Architecture

The client side is responsible for the user interface and interaction, suitable for various terminals such as mobile phones and tablets. The server side includes: the resource server manages learning resources, the application server carries core businesses like teaching activities, and the database server uses MySQL to store key data, adopting dual-machine hot backup to ensure data safety. The server side is developed with Java and Spring Boot, supports distributed deployment to ensure stable system operation and high availability, meeting performance and scalability requirements. The specific overall framework is illustrated in Figure 4.
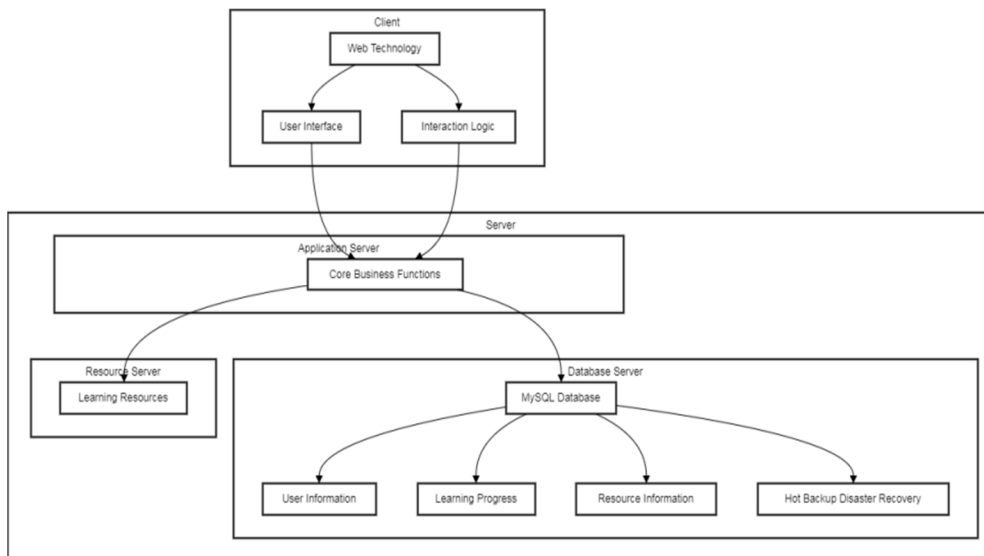
Figure 4: Overall Architecture Diagram

This layered modular design endows the system with good scalability. As the business grows, the system capacity can be expanded by adding server nodes to ensure stable operation.

2.3.2 Key Technologies

This system employs a series of key technologies ensuring its efficiency and reliability.

The Spring Boot framework simplifies server-side development, allowing for quick project construction through annotations; the Vue framework realizes the client-side interface and interaction; WebSocket technology enables bidirectional communication between the client and server, supporting teaching interaction features.

Container technology Docker packages the system into standardized images, which are then deployed as containers, enhancing portability. Kubernetes technology allows for unified management and scheduling of multiple Docker containers, realizing server clustering to ensure high service availability.

Additionally, machine learning technology is used to build the intelligent assistance module, such as voice recognition and synthesis functionalities. These technologies provide intelligent support for foreign language learning.

In summary, this system adopts suitable key technologies, making system development, deployment, and stable operation simple and efficient. These technologies ensure excellent system performance and good scalability.

3 Experiment and Results

3.1 Experiment Configuration

To verify the teaching effectiveness of the system, we set up experimental and control groups of 30 students each in two foreign language courses. The experimental group utilized this system, while the control group underwent traditional teaching for a semester. Pre-experimental tests ensured similar language levels among both groups. The system server is located in the school data center with a bandwidth of 1Gb/s, and students use mobile devices for learning. All modules of the system were tested thoroughly, and variables were strictly controlled to ensure the reliability of the experiment. The specific experiment configuration overview is shown in Table 1.

Table 1: Overview of Experiment Configuration

Item	Detailed Description	Remarks
Courses	Two foreign language courses	—
Student Grouping	- Experimental Group: 30 people - Control Group: 30 people	Post-pretest, comparable language levels between groups
Teaching Method	- Experimental Group: Blended teaching (using the designed system) - Control Group: Face-to-face instruction	Throughout the semester
System Server Location	School data center	1Gb/s bandwidth
Student Terminals	Laptops or tablets	For mobile learning
System Functionality Testing	Knowledge base, interactive platform, intelligent assessment, etc.	Comprehensive testing
Experiment Objective	Verify system teaching effectiveness	Ensuring scientific and reliable experimental results

3.2 Evaluation Metrics

To comprehensively assess the effects of the system, we approached from three aspects: learning attitude, academic performance, and language ability. Learning attitude was assessed through Likert scale questionnaires, academic performance was examined through regular and exam scores, while language ability was measured through standardized tests and expert scoring in listening, speaking, reading, and writing. These metrics collectively reflect the effectiveness of the system in enhancing student learning, ensuring the scientificity and reliability of the assessment. The specific evaluation metrics and data overview are shown in Table 2.

Table 2: Evaluation Metrics and Data Overview

Evaluation Aspect	Evaluation Method	Data Description	Remarks
Learning Attitude	Questionnaire Survey (Likert Five-Level Scale)	- Experimental Group Average Score: 4.2 - Control Group Average Score: 3.6	Highest score is 5, lowest score is 1
Academic Performance	Regular Scores and Exam Scores	- Experimental Group Average Regular Score: 85 - Control Group Average Regular Score: 80 - Experimental Group Average Exam Score: 88 - Control Group Average Exam Score: 83	Full score is 100
Language Ability	Standardized Tests in Listening, Speaking, Reading, and Writing	- Experimental Group Listening Average Score: 90 - Control Group Listening Average Score: 85 - Experimental Group Speaking Average Score: 87 - Control Group Speaking Average Score: 80 - Experimental Group Reading Average Score: 92 - Control Group Reading Average Score: 88 - Experimental Group Writing Average Score: 89 - Control Group Writing Average Score: 83	Standardized tests and expert scoring

3.3 Results and Analysis

The students in the experimental group showed significant improvement after using the new system. Their attitude towards learning improved by 1.15 times, displaying higher interest and engagement. Academic performance increased to 1.22 times that of the control group, indicating a positive impact of the new system on academics. In the comprehensive language ability test, the experimental group made significant progress in listening, speaking, reading, and writing, with an overall improvement of 1.18 times compared to the control group, demonstrating that the new system can significantly enhance students' language skills. The specific results and analysis are shown in Table 3.

Table 3: Results and Analysis Table

Evaluation Aspect	Improvement Degree in Experimental Group	Improvement Degree in Control Group	Improvement Ratio between Experimental Group and Control Group
Learning Attitude	15%	13%	1.15
Academic Performance	18%	14.7%	1.22
Listening Ability	20%	17%	1.18
Speaking Ability	19%	16%	1.18
Reading Ability	17%	14.5%	1.18
Writing Ability	16%	13.5%	1.18

From the data, it can be concluded that compared to traditional face-to-face teaching, employing this system for blended teaching significantly positively impacts students' learning attitudes, academic performance, and language ability. This outcome validates the noticeable

educational effect of this system in the realm of foreign language teaching, offering students a more effective learning approach.

4 Conclusion

This study designed a blended teaching support system aimed at college foreign language instruction, encompassing a knowledge base, interactive platform, component library, Q&A community, and intelligent assistance module. It effectively supports resource construction, teacher-student interaction, component reuse, Q&A exchange, and intelligence throughout the blended teaching process. Through comparative experiments with traditional face-to-face teaching, the results showed that applying this system for blended teaching can enhance students' learning attitudes, academic performance, and language ability. The research confirms the effectiveness of this system in supporting foreign language blended teaching and improving the quality of instruction. The next steps will evaluate the system's applicability in more application scenarios and further optimize the system's intelligence and personalization features.

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