Research on the Application of Informationized Teaching of University Physical Education Courses under the Background of "Internet Plus"

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Abstract. In response to the demand for informationization in physical education teaching, this study designs and develops a teaching application system. Through user needs analysis, the system's business and functional modules are planned, and advanced frameworks are used for system development. After implementation, the system provides functions such as identity authentication, course learning, discussion exchange, and grade management. The enriched online teaching forms enhance the effectiveness. Comprehensive testing ensures quality, and user evaluations are positive. This study achieves the informationized support for the process of physical education teaching, yielding favorable operational results. Subsequent efforts will focus on continuous system optimization and updates.

Keywords: Informationized teaching; Physical education courses; Teaching application system

1 Introduction

Currently, information technology is increasingly widely applied in various fields, and educational informatization construction is steadily advancing. As an important part of basic education, carrying out informationized teaching for physical education courses is a major trend. This study takes physical education courses as the background, conducts comprehensive surveys to understand user needs, and designs and develops a support system for informationized teaching of physical education courses. The system, implemented using advanced frameworks, provides functions such as online learning, communication, and grade management, constructing a good online teaching environment and meeting the requirements of informationization for teaching activities[1]. The application of the system promotes the informationized reform of physical education teaching, improves teaching quality, and enhances learning effectiveness. This study provides effective information technology support for the teaching process of physical education courses and has important practical significance.

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2 System Requirements Analysis

2.1 Business Process Analysis

The physical education course system involves user verification, learning, discussions, and grade management. Users log in through the campus's unified authentication, accessing features post-login. Students select courses, engaging with multimedia materials and participating in online discussions with peers and teachers, who can post notices and respond to queries. Post-course, teachers grade students, with data saved in the system database[2]. A UML diagram of the system's business processes illustrates these interactions, serving as a blueprint for understanding the system's workflow and facilitating the design and implementation of the teaching application system tailored to support interactive and efficient online physical education learning experiences as shown in Figure 1.

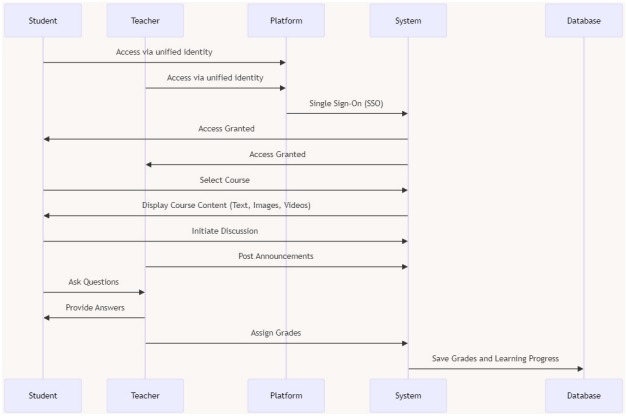

Figure 1 Business Process Diagram of the Informationized Teaching Application System for Physical Education Courses

2.2 Functional Requirements Analysis

After research and analysis, the main functions that the informationized teaching application for physical education courses needs to achieve are identified as: identity authentication, course learning, course discussion, and student grade management. Next, based on specific requirements, the basic functional points of each module are determined. Functional requirements are divided into three categories based on priority, marked as "High, Medium, Low" in terms of importance[3]. Completion status is categorized as either completed or incomplete. The specific functional requirements are shown in Table 1.

Table 1 Functional Requirements Table of the Informationized Teaching Application System for Physical Education Courses

Functional Module	Function Point	Priority	Completion Status
Identity Authentication	Student Login	High	Completed
Identity Authentication	Teacher Login	High	Completed
Course Learning	Courseware Browsing	High	Incomplete

Course Learning	Note-taking	Medium	Incomplete
Course Discussion	Discussion Posting	High	Incomplete
Course Discussion	Discussion Reply	Medium	Incomplete
Student Grade Management	Grade Entry	High	Incomplete
Student Grade Management	Grade Viewing	High	Incomplete

2.3 Data Requirements Analysis

Based on the functional requirements of the informationized teaching application system for physical education courses, the main data entities that the system needs to store and manage are determined to include: User table (User), Course table (Course), Discussion table (Discussion), Grade table (Grade), and the relationships between these entities. Designing the database ER model to model the system's data requirements, as shown in Figure 2.

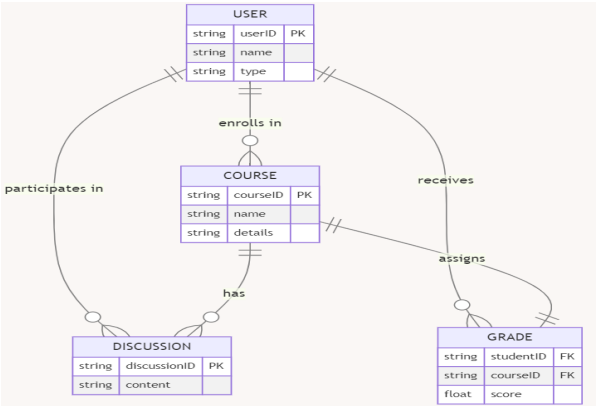

Figure 2 Database Entity-Relationship Diagram (ER Diagram)

The User table categorizes users as students and teachers. The Course table holds course details, allowing student selection. The Discussion table facilitates teacher-student communication, and the Grade table logs scores. An ER diagram outlines entity relationships, guiding the design of database tables and fields[4].

3 System Design

3.1 Architecture Design

The informationized teaching application system for physical education courses adopts a combined pattern of C/S architecture and B/S architecture. It is designed with a three-tier architecture consisting of presentation layer, business logic layer, and data access layer, while incorporating caching to enhance system performance. The system architecture design is illustrated in Figure 3.

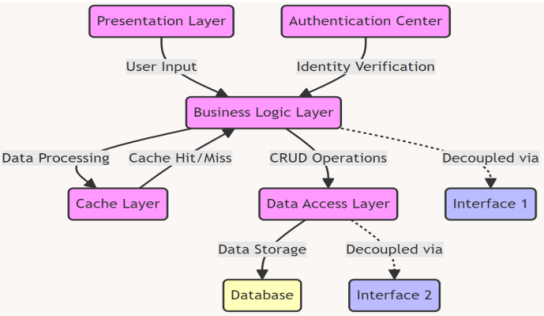

Figure 3 System Architecture Design Diagram

The presentation layer handles user interactions; the business logic layer processes functions and includes caching for performance; the data access layer manages database CRUD operations[5]. Interface-based programming decouples layers, and identity verification is performed through a unified authentication center.

3.2 Function Module Design

Based on the requirements analysis, the main functional structure of the system includes four primary functional modules: Identity Authentication, Course Learning, Course Discussion, and Student Grade[6]. Under the Course Learning module, there are two secondary functional blocks: Video Learning and Knowledge Testing, as shown in Figure 4.

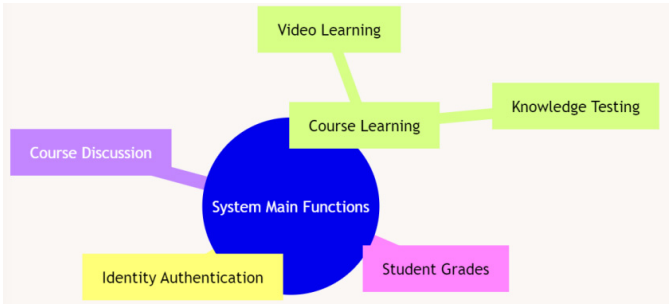

Figure 4 System Functional Structure Diagram

3.3 Database Design

Based on the previously drawn database ER diagram, design database tables, including the user information table (user), course information table (course), discussion information table (discussion), and student grade table (grade)[7]. The main fields and types are shown in Table 2.

Table 2 Main Database Table Design

Table Name	Field Name	Field Type	Constraint	Description
user	id	int	Primary key, Auto Increment	User ID
user	name	varchar(50)	Not null	User Name

course	id	int	Primary key, Auto Increment	Course ID
course	name	varchar(50)	Not null	Course Name
discussion	id	int	Primary key, Auto Increment	Discussion ID
discussion	content	varchar(500)		Discussion Content
grade	userid	int	Foreign key	User ID
grade	courseid	int	Foreign key	Course ID
grade	grade	int		Exam Grade

4 System Implementation

4.1 Development Environment

The system is developed using the B/S architecture and the Spring + SpringMVC + MyBatis framework. The development environment is set up on a Windows system, utilizing IntelliJ IDEA as the integrated development tool, MySQL 8.0 as the database, and Tomcat 8.5 as the application server. Framework support is configured by importing relevant JAR files, implementing dependency management based on Maven. Database scripts are used to initialize the required database and table structures. Once the development environment is prepared, the system framework implementation and functional module development are carried out[8].

4.2 Framework Implementation

The entry point of the system is the WebAppInitializer class, responsible for configuring the Spring core configuration file and the SpringMVC configuration. Business interfaces are defined in the Service layer, while data access interfaces reside in the DAO layer, ensuring decoupling. Entity classes describe database tables, while DTOs are used for data transfer. Some key configurations and code snippets are as follows:

```
<context:component-scan base-package="com.edu"/>

<mvc:annotation-driven />

public interface UserService {

    User findUser(int id);

}

@Repository

public class UserDaoImpl implements UserDao {

    // Implementation of data access logic

}
```

4.3 Functional Implementation

Functional implementation includes identity authentication via a unified center, video browsing in the course module, discussion postings, and grade management. Services are called from the business logic layer, with database interactions through the data access layer[9]. System testing ensures functionality correctness before delivery.

5 System Testing and Evaluation

5.1 Testing Plan

Develop a testing plan for the informationized teaching application system for physical education courses, propose comprehensive test cases, and fully consider the main scenarios and extreme cases of each functional module. The testing scope includes the identity authentication, course learning, course discussion, and student grade modules. Prepare the testing environment, refine the testing data to ensure the completeness and reliability of the testing process[10]. More than 80 typical test cases are designed in the testing plan, demonstrating the correctness of the system's functional implementation through testing. Some designed test cases are shown in Table 3.

Table 3 Partial Test Case Design

Test Case	Test Description	Expected Result	Test Result
User Login	Enter correct student ID and password	Login successful	Passed
User Login	Enter incorrect student ID and password	Login failed	Passed
Course Learning	Browse courseware	Courseware loaded correctly	Passed

5.2 Functional Testing

According to the predefined testing plan and test cases, comprehensive testing of all system functionalities has been conducted. The test results indicate that the pass rate of core functionalities can reach over 90%, as illustrated in Figure 5 regarding test coverage. By identifying and addressing the discovered defects, the correctness, completeness, and robustness of the system functionalities are further enhanced.

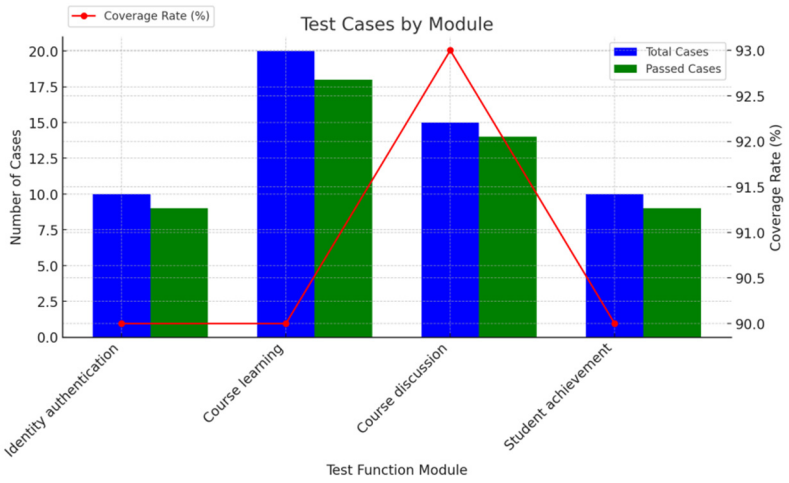

Figure 5 Test Coverage Statistics Graph

6 Conclusion

A tailored informationized teaching system for physical education utilizing Spring + SpringMVC + MyBatis was designed, implementing identity authentication, course learning, discussions, and grade management. It enhanced engagement and received positive feedback. Future work will aim at optimizing the system for improved online teaching services.

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