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Research on Interactive Experience of Internet Technology in Flipped Classroom Teaching Mode

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Abstract

High-quality resources and services are an important guarantee for effective flipped classroom practice. For this reason, a system that can meet the needs of resources and services in all aspects of flipped classroom teaching has been designed. The system has the characteristics of serviceability and innovation, personalization and intelligence, reasonable resource classification and open co-construction and sharing, interactivity and immediacy, maintainability and scalability. On the basis of making full use of WinCC visualization and MATLAB's powerful computing functions, combined with OPC technology, developed a set of virtual process control experimental teaching system that is easy to expand, friendly interface, and open algorithm. On this basis, a process control system flip class is built. Teaching mode. This teaching mode has a significant effect on students' deepening understanding and mastery of process control system design and improving engineering practice ability.

Keywords

Internet; Flipped Classroom; Interactive Experience; Virtual Experimental Teaching System.

1. Introduction

With the continuous deepening of teaching reform, the classroom teaching model continues to progress and develop. As a new teaching model, flipped classroom has been widely used in modern teaching. In flipped classroom mode, teaching is through the exchange of teaching roles, and flipped classroom is one This new type of multimedia information teaching mode can adapt to the needs of remote multimedia interactive teaching in various disciplines. The feasibility and effectiveness of flipped classroom implementation requires certain resources and service support. At present, there are many online open learning platforms at home and abroad that provide a large number of free courses. The rise of three major foreign course providers, Coursera, Udacity, and edX, has given more attention. Many students provide the possibility of systematic learning, and many universities have also cooperated with them to launch high-quality courses [1]. There are domestic platforms such as MOOC, Xuedong Online, and China University MOOC. The course resources are rich and the number of course users is huge. It provides some courses for the implementation of flipped classrooms. It is possible, but its resources mainly provide students with more channels for independent learning of courses, and cannot provide support for the implementation of flipped classrooms for all courses. They are not for teachers and students to carry out classroom teaching and provide a flexible, easy-to-use and popular platform. This article uses ASP.NET and SQL Server database technology to design a service system that supports flipped classroom teaching design [2]. The system receives the collection and display of all courses and various resources. The course resources are rich, the course categories are complete, the media types are diversified, the question bank is large, the learning community is interactive, and it automatically collects resource data and learning behavior data. Intelligent analysis of data provides comprehensive support and services for flipped classrooms.

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2. The Overall Design of the Experimental System

2.1. System Architecture

In the PLC flipped classroom teaching mode, students are the main body of the entire teaching process and the "protagonist" of classroom teaching; they complete the memory and preliminary understanding of knowledge before class, and carry out advanced recognition of knowledge application, analysis, and evaluation in class. Know the content. In order to realize this flip, teachers need to design more practical problems and experiments according to the teaching goals of each knowledge point, and guide students to analyze problems, propose plans, verify plans and evaluation plans in the classroom, and finally achieve the goal of knowledge, ability and evaluation [3]. Emotional teaching goals. In the entire classroom teaching process, a teaching experiment system that can carry out a "student-centered" teaching experiment system is needed to meet the needs of program verification, analysis, and evaluation activities. According to the above requirements, the main design idea of the entire experimental system is to use computer and virtual simulation technology to virtualize and program the controlled object. The use of wireless communication technology to reduce the line connection as much as possible to facilitate the development of classroom experiments. Based on this leading idea, the new PLC classroom experiment system is shown in Figure 1 (picture quoted from the effects of flipped classrooms on undergraduate pharmaceutical marketing learning: A clustered randomized controlled study). The experimental system consists of three parts: virtual controlled object, physical PLC and student computers.

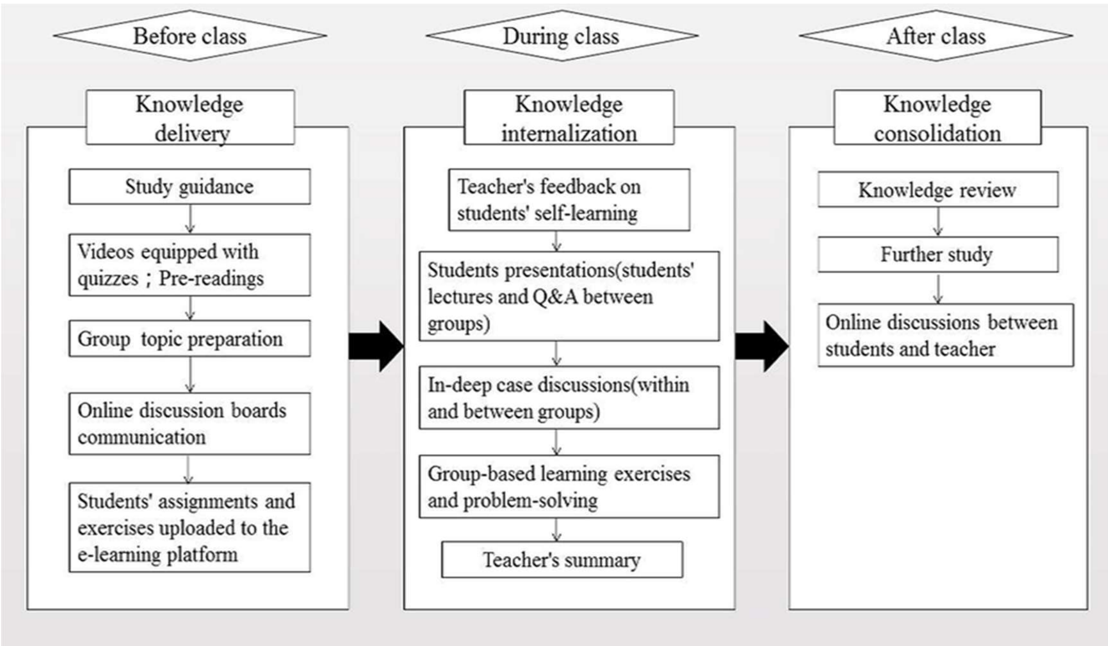

Figure 1. Experimental system structure

2.2. System Function Design

The design of this system mainly revolves around the four parts of the implementation of the "flipped classroom" teaching model, including pre-class tasks, classroom activities, after-class tasks and course evaluation. In the pre-class task stage, teachers and students need to log in to the online teaching system and fill in their personal information [4]. Teachers create courses through the system, fill in the course information, and upload course resources (micro-class videos, electronic lesson plans, course materials, etc.) after obtaining the course invitation code, and before class for test and voting questionnaires, students use the course invitation code notified by the teacher to enter the course study. Each time they enter the system to study, the

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system will remind the student to sign in to obtain the course experience value. After that, the student can proceed to this study, when the student completes the corresponding chapter After the pre-class task learning, testing and voting questionnaire, the corresponding course points can be obtained, which is helpful for the course evaluation, where the teacher can obtain the students' pre-class learning situation in time to prepare for the subsequent classroom activities; in the classroom activity stage In the course, teachers put forward a number of topics for discussion, teachers and students solve problems through communication, and then expand the content of the teacher's course and summarize the contents of the teachers and students; the after-school task phase is mainly through the course project to consolidate the course skills, students complete the project through teamwork, and the teacher can check it at any time Students complete the situation and provide guidance; in the course evaluation stage, the teacher evaluation and student mutual evaluation can be conducted through the course points and course experience values obtained by the students in the pre-class tasks, class activities and after-class tasks. The overall architecture design of the online teaching system based on the flipped classroom on the Android platform is shown in Figure 2 (the picture is quoted from A self-regulated flipped classroom approach to improving students' learning performance in a mathematics course).

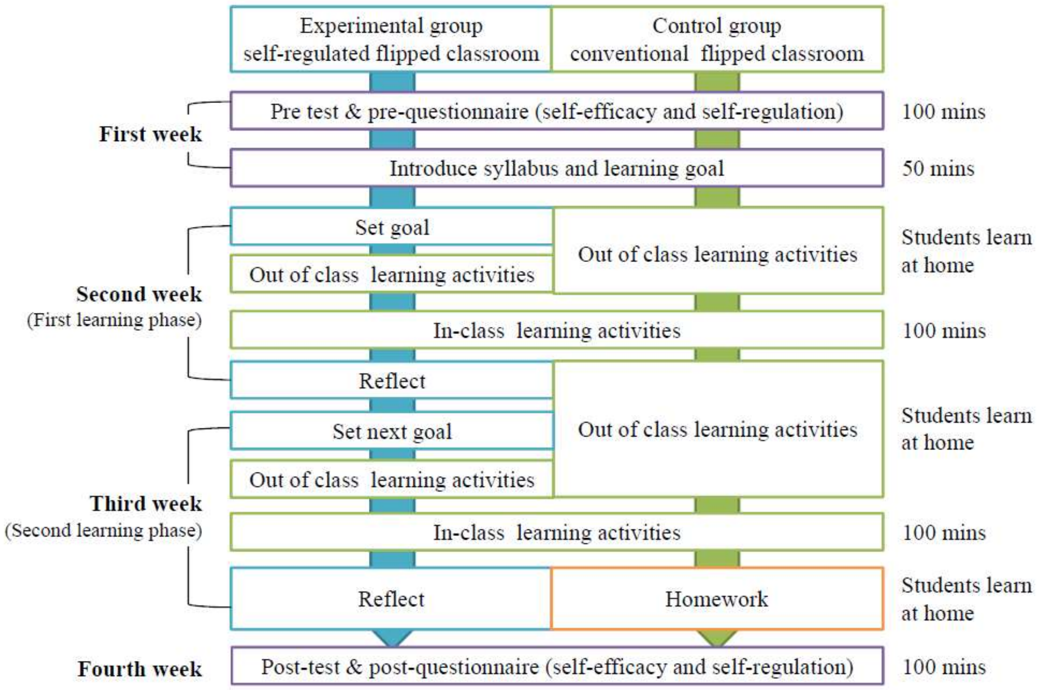

Figure 2. System functions

2.3. Database Conceptual Design

The users of this system mainly include front desk customers and system administrators. The front desk users are divided into two categories: teacher customers and student customers. The entities involved in the system also include learning materials, message messages, and course information. The administrator manages multiple student information, and there is a one-to-many management and managed relationship between the administrator and the student. In addition, an administrator can also manage multiple course information, material information and message messages. There is a one-to-many management and managed relationship between the administrator and the courses, materials, and message information [5]. The ER diagram of the administrator and the student is shown in Figure 3 (picture Quoted in MOOC model: Dimensions and model design to develop learning). A student can browse the basic

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information of the course and view related information. There is a one-to-many management and managed relationship between the student, the course and the information. In addition, a student can also post multiple message messages, and there is a one-to-many management and managed relationship between students and message messages. The E-R diagram of students, course information, and material information is shown in Figure 4 (picture quoted from MOOC model: Dimensions and model design to develop learning).

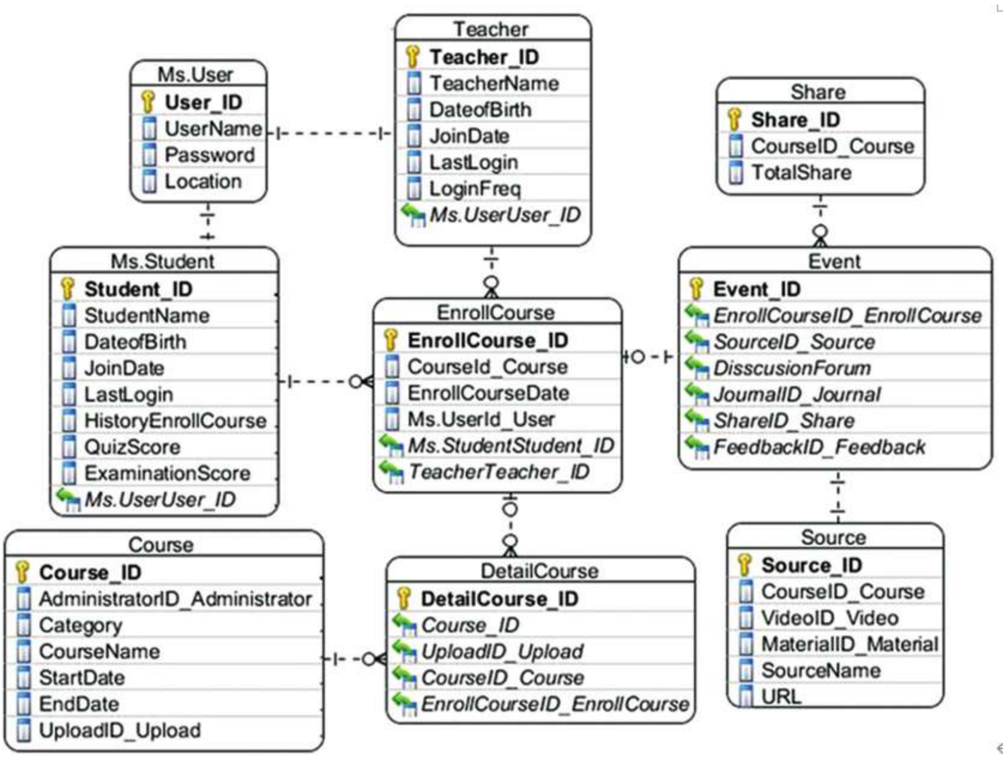

Figure 3. E-R diagram of administrators and students

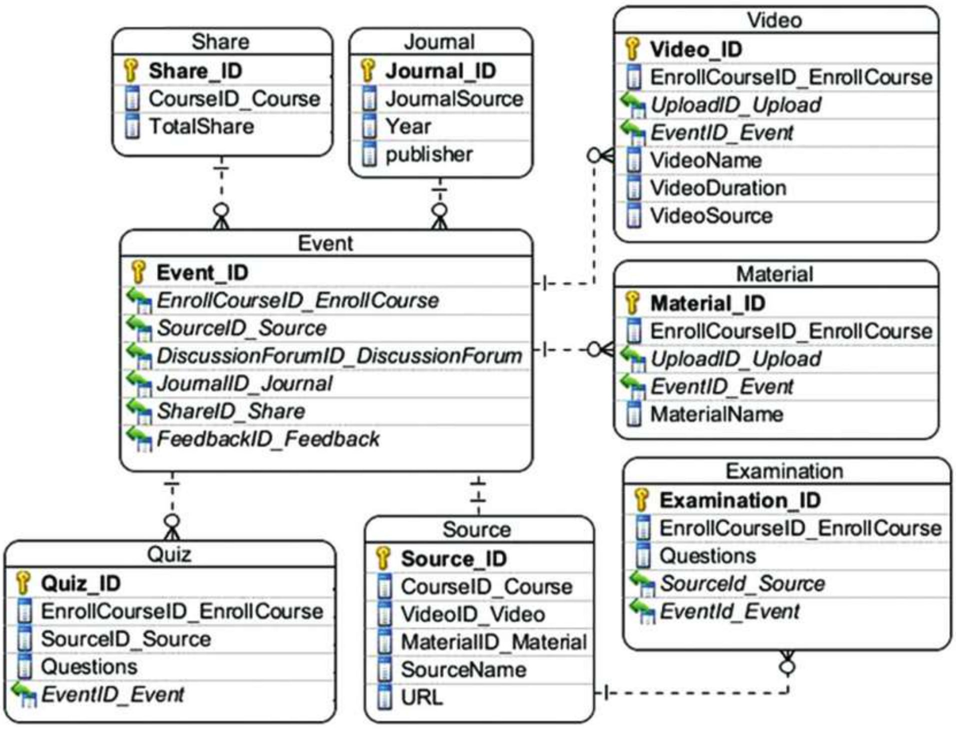

Figure 4. E-R diagram of students, courses, and material information

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3. System Software and Hardware Development

3.1. System Software Development and Realization

Under the electronic 3D virtual reality visual simulation environment, the three-tier architecture design of the flipped classroom remote teaching system is carried out, the multimedia teaching platform is constructed based on the TCP/IP protocol and the C/S model, and the visual simulation design of the remote teaching system is carried out [6]. The simulation software design includes network communication module, data acquisition module, interface rendering and 3D modeling module. The initialization scene receives the control program design through the serial port. According to the above analysis, assign the serial bus control first address of the flip classroom remote teaching system to the address pointer, establish a software development environment in the Linux operating system, and establish a three-dimensional teaching scene model through the Audio Sound-Spatial module provided in Vega Prime. Under the SCL architecture of the service capability layer of interface access, the WEB-GIS browser is used for information transmission and visual development to realize electronic 3D virtual reality simulation.

3.2. Experimental System Hardware Design

According to the overall design of the system, the hardware of the experimental platform mainly includes: projection system, virtual controlled object, physical PLC and programming/debugging computer. The projection system can use the multimedia system that comes with the classroom; the programming and debugging computer can allow students to bring their own personal laptops; and the physical PLC part is mainly composed of PLC and wireless routing modules. The brand of PLC, the type and quantity of I/O modules and special function modules can be determined according to the content and needs of the courses taught [7]. The hardware of the virtual controlled object is more complicated. First, it needs a computer and related software to build an internal soft model that can highly restore the real device. And the model can be controlled arbitrarily by changing the value of the variables. This method solves the virtualization problem of the actual controlled device very well, but the virtual model cannot be directly connected to the actual circuit. Therefore, in order for the PLC to control the virtual controlled object, it is necessary to "map" the control variables in the model to the actual input and output circuits. For ordinary notebook computers, they do not have common industrial signal input and output channels, but they have various communication interfaces, such as Ethernet and USB. Therefore, you can use this feature of the computer to select some remote I/O modules with communication functions to solve the problem of the lack of signal interfaces in the computer. The specific solution is shown in Figure 5 (the picture is quoted from Agile Robot Development (aRD): A Pragmatic Approach to Robotic Software).

The computer realizes the modeling, simulation and display of the actual controlled object, and projects all the displayed content on the large screen, which is convenient for carrying out experiments in the classroom; the virtual controlled object I/O interface box corresponds to the variables in the model on the actual I/O circuit, it is convenient for the entity PLC to control. In the I/O interface box, digital I/O modules and analog I/O modules are the center of the entire "virtual and real" mapping.

On the one hand, they correspond the variables in the model with their own I/O channels through wireless Ethernet; on the other hand, they connect these channels to the patch cord panel through hard wiring to facilitate external wiring.

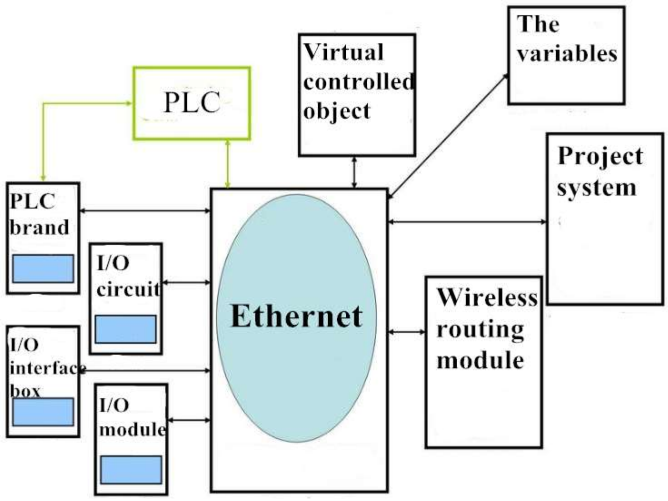

Figure 5. Virtual controlled object hardware structure

4. System Algorithm Design

4.1. Implementation of the Back-End Model Layer

We select a single-capacity water tank to establish the following mathematical model:

$$R_2 S \frac{d\Delta h}{dt} + \Delta h = R_2 \Delta q_1 \tag{1}$$

We use MATLAB to write the differential equation functions of the above three models, and use the fourth-fifth-order Runge-Kutta algorithm ode45 for simulation [8]. Considering the upper and lower limits of the valve of the real water tank system, the anti-integral saturation PID controller is designed to control the liquid level of the water tank. The idea is: when the control quantity enters the saturation zone, only the accumulation of weakening the integral term is performed, and the accumulation of increasing the integral term is not performed. The specific algorithm is as follows:

$$u(k) = K_p e(k) + K_I E(k) + K_D \left[e(k) - e(k-1) \right] \tag{2}$$

4.2. Data Communication Layer Realization

The real-time data exchange between the front-end interface layer and the back-end model layer is the key to the entire experimental platform. The method development of ActiveX and OLE for Process Control OPC (OPC) is selected to realize the call and data communication of the MATLAB engine by WinCC. (1) MATLAB engine call and simulation process control based on ActiveX technology. The built-in VB script in the WinCC software supports the Active X Automation control terminal protocol. By establishing an ActiveX connection, it realizes the call to the MATLAB engine and controls the simulation process. (2) Data communication based on OPC technology. This system uses WinCC as the OPC server and MATLAB as the OPC client. The data communication is first set up in WinCC internal variables, and then programmed in MATLAB.

5. Conclusion

Flipped classrooms and smart classrooms are currently popular teaching practice models in colleges and universities. In order to improve the quality and level of teaching, rich, high-quality resources and services are needed to support teaching. This system fully supports the demand for resources and services in all aspects of flipped classroom teaching. It is oriented to teacher and student user services, and can give full play to the positive initiative of teachers' flipped classroom teaching design and students' independent learning, collaborative learning, and mixed learning. Through research and practice, it is found that users not only pay attention to the convenient acquisition of high-quality courses and resources, the release and sharing of their own courses and resources, powerful free interaction functions and intelligent data analysis functions, but also expect the system to be a dream factory and wisdom for innovative activities. The crystalline display area, therefore, the system functions need to be further improved in the later stage, to enhance the user experience, and to promote the application.

Acknowledgments

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