



Design of PLC Technology Courses Based on Blended Learning in Colleges and Universities

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Abstract. PLC technology course is a specialized course of electronic information engineering major of our school. It contains several programming languages such as sequential function chart, logic block diagram, statement list, ladder diagram, etc. It is important in cultivating and improving students' programming ability effect. Combining the characteristics of PLC technology course with the advantages of hybrid teaching method, this paper studies deeply from curriculum construction, instructional design to curriculum evaluation. Based on the Blended learning method, the "online" and "offline", The combination of theory and experiment teaching model, to optimize the teaching quality of PLC technology has a positive role in promoting.

Keywords: Blended learning · College teaching · Teaching process design

1 Introduction

With the advent of the information age, informationization has become a trend of higher education development. Mooc class, micro class, flip the classroom and other teaching methods appear in the daily teaching activities of various colleges and universities. The use of network resources and multimedia resources to optimize and assist the teaching of traditional classroom teaching, known as the hybrid teaching. As an important component of modern educational philosophy, hybrid teaching maximizes the advantages of traditional teaching and online teaching. But this advantage does not come naturally, it requires the careful design and implementation of the instructor.

PLC technology as a professional course of electronic information engineering, the course has a strong practicality, through the use of the PLC on the machine to understand its function; the same time, the course has a high degree of comprehensiveness, from the principle of the curriculum. It integrates basic knowledge of logic control, analog control, high-speed position control, pulse control and networking from an application point of view, combining knowledge of electrical control, analog electronics, digital electronics, computer programming, Communication control, etc.; In addition, the course is highly creative and requires creative instruction programming to solve practical production problems. In this context, how to use the hybrid teaching methods to optimize the teaching quality of PLC technology courses is of great significance.

2 Mixed Teaching Theory and Technical Basis

2.1 Mixed-Type Teaching Theory

Hybrid teaching is the traditional combination of face-to-face classroom learning and online learning (Fig. 1). The core idea is to solve it according to different problems and adopt different ways to solve them. Teaching involves different media and information transmission teaching. In the process of implementation, students should pay attention to the vital needs of knowledge according to the humanism and make them develop more. To some extent, the humanistic view of learning foreshadows the trend of instructional law. Rogers, the representative of humanistic thought, applies the humanistic psychology theory to teaching research and experiment, confirms the theory of “affective teaching” and “student-centered teaching mode”. To overcome the traditional teaching emphasis on social function, neglect the development of personality development function, lack of initiative of students learning and other shortcomings, has a certain enlightenment and positive significance.

Jennifer Hofmann points out in the B-Learning Case Study that the idea behind hybrid learning is that instructional designers break up a learning process into many modules and then decide to use it to the best media present these modules to learners.

From this notion, it can be seen that Jennifer Hofmann and others agree that blended learning presents the best module (or combination of modules) for learner learning using the best media (or media mix) to achieve the best learning effect of teaching design ideas.

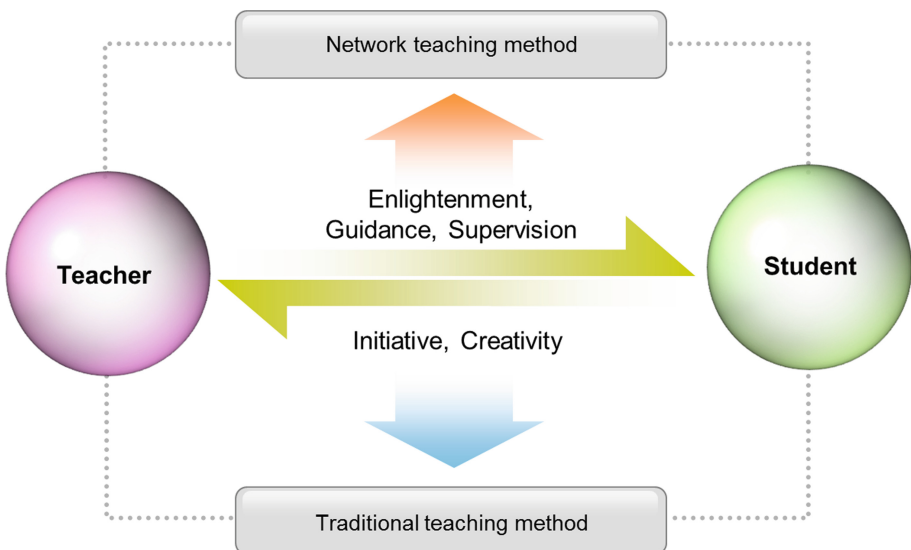


Fig. 1. A hybrid teaching

2.2 Hybrid Teaching Technology Base

Electronic performance support systems and knowledge management techniques provide the technical basis for blended instruction. E-Performance Support System is a work-support and learning support system that provides an integrated resource to facilitate efficient work or learning through the provision of templates, flexible help, expert systems, guides, flowcharts, and all other forms of media. Knowledge management techniques such as sociology, information management, psychology, education and other multidisciplinary and multi-disciplinary advanced concepts, in practical applications for educational technology reference and migration.

3 Course Construction

The PLC technology course is a specialized course for electronics professionals. This course teaches PLC technology widely used in modern control field based on the control technology (i.e., program control) based on the relay control circuit in the field of automatic control. As shown in Fig. 2, PLC technology courses teaching objectives specifically divided into knowledge goals, skills goals, process goals and values goals.

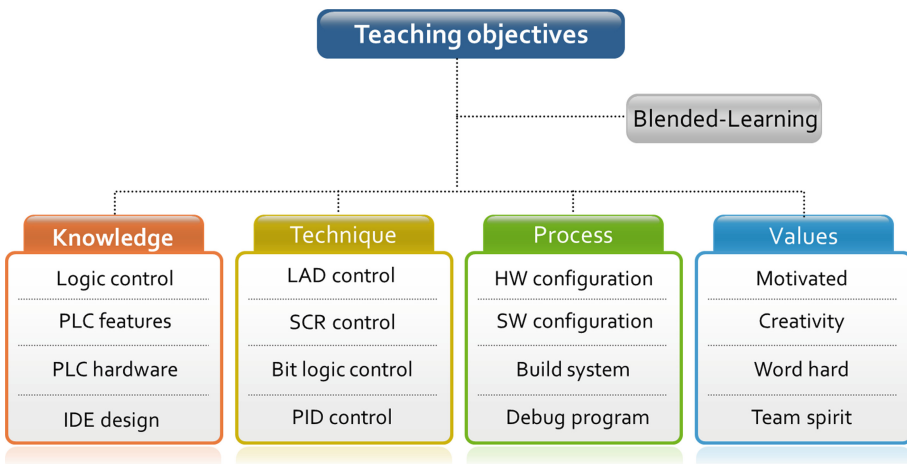


Fig. 2. PLC teaching objectives

4 Mixed Teaching Design

4.1 Design Principles

4.1.1 For Different Personality Students, Teaching Students According to Their Aptitude

Each student’s learning abilities directly affect their learning efficiency. In the classroom, the teacher’s knowledge is directed at most of the students in the class, often

failing to cater to students with high scores and those with poor grades. Students who have scores above and below the class average can take a 1-on-1 online course to explain their knowledge. For students with excellent performance, teachers can interact deeply with students through online learning platform. For students with relatively poor grades, students can simplify the knowledge in the classroom and solve their problems.

Teachers through the online interaction to make up for offline teaching problems, answer students' questions, solve student problems, ensure that each student can really learn each knowledge point, and get more time to establish links with students to increase teachers and students' emotion.

4.1.2 Different Teaching Methods to Match Different Teaching Methods

Because of the limitation of time and space, the traditional teaching classroom unifies the process of "teaching" and "learning" in the classroom, resulting in fast paced classroom, low participation of students and inefficient teaching. Hybrid learning can adjust the teaching methods for these problems, and use video, audio, images and other forms to solve problems that are not solved in time online and communicate with students. "Teaching" and "learning" through online and offline organic combination, can make teachers in the limited class time will focus on difficult points to the students.

4.2 Mixed Teaching Content Design

Different from the traditional teaching mode, the hybrid teaching makes the students not only confined to the classroom when acquiring knowledge, but also exchanges with the teachers not only in the classroom. The entire teaching activities require the cooperation of teachers and students, teachers become the guide of the curriculum, the students become the main body of teaching, which greatly improves the learning initiative and improves and perfects the curriculum through the joint efforts of both parties. In this process of mutual learning and mutual promotion, the teacher is no longer just a simple communicator of knowledge. The teaching process is not merely the repetition of machinery. Instead, teachers and students cooperate with each other and think together. Teachers should understand that the students have Experience and foundation, and create a suitable situation and activities for students, so that students learn more in the learning process.

The teaching content mainly includes three aspects: one is teaching resources centered on micro-video and interactive exercises; the other is innovative experimental design; and the third is teaching activities aimed at teaching resources.

The construction of teaching resources is mainly based on the concept of "fragmentation", the teaching knowledge unit as short as possible, specific, so that students can digest and understand in a short time. Innovative experimental design is different from the previous confirmatory experiments. In the confirmatory experiment, the students are all mechanical input teachers to release the program. The output of the operation and the analysis results lead to the low enthusiasm of students and the too small expectation of the experimental results. Innovative experimental design is designed for a particular principle of a special task, grouping allows students to complete the process from program design, program debugging to run the entire process, and to sum up, and there should be exchanges between groups and groups,

analysis and experience. The design of teaching activities is divided into before class, class, and after-school.

(1) Before class part

Develop a detailed before class learning tasks, summarize the knowledge of the previous section and send it to students. Students are required to preview the contents of this lesson, master the principles, write the program, and send it to the students' knowledge points. During the preview process, students can communicate with teachers via online platforms, We Chat, email and other means of communication at any time. Teachers check through the hybrid teaching platform before the next class begins.

(2) Part of the lesson

In the hybrid teaching mode, classroom teaching is the most effective way of communication between teachers and students. The course is divided into two sections according to time. The first half of the section mainly explains and sorts out the knowledge points. The second section mainly focuses on question answering. At the end of the class, the teacher posts the learning tasks in the next section and informs the student about the resource link.

(3) After class part

In the hybrid teaching platform to modify homework, some of the typical problems that exist in students to organize, check each student's progress and learning status.

5 Course Evaluation

The traditional teaching model evaluates students' learning only in the final exams. As a result, many students do not usually study at the end of the exams. They take a comprehensive assault before the final exams, and their participation in learning is not high enough to deal with the exams. In a blended teaching model, evaluating a student's learning can actually achieve procedural evaluation. In the evaluation of the dimension is not limited to the final grade in the class and the final exam scores, but also the completion of each knowledge point in the teaching task, the completion of each experiment, the whole dimension of the students' learning evaluation. Evaluation of quantitative methods shown in Table 1, the assessment criteria shown in Table 2.

Table 1. Learning process evaluation method of quantification

Evaluation type	Evaluation object	Standard	Level
Process	Pre-mission record Platform practice scores	Duration Score	Understanding Analysis
Formative	Student discussion Online test Group activity	Knowledge points Score Theme tasks	Understanding Analysis
Summary	Experimental test Final exam	Score Score	Understanding Analysis

Table 2. PLC technical courses grade assessment standards.

Pre-mission record	10%	Usual grades 70%
Student discussion	30%	
Group activity		
Platform practice scores	10%	
Online test	20%	
Experimental test	10%	
	20%	

6 End

Based on the analysis of the hybrid teaching theory, combined with the characteristics of PLC technology courses, designed based on hybrid teaching of PLC technology courses teaching, to improve student learning participation, programming ability, ability to solve practical problems is very helpful. Under this mode, through the guidance of teachers and the active participation of students, the quality of teaching is greatly optimized, and there are also positive references for other courses.

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