

The Teaching Practice of the Integration of Deficiency and Reality in PLC Course under the Background of Epidemic Situation

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Abstract

The normalization of the epidemic situation makes the teaching reform of practical courses extremely urgent. Taking the PLC application course as an example, this paper analyzes the teaching difficulties of similar practical courses, and puts forward some concrete solutions. Based on online resources, PLC cloud platform is designed and applied to carry out virtual and real integrated teaching, and typical pre-class, in-class and after-class practice models are given. The practice shows that this method can improve the teaching effect of practical courses, and the students have a good evaluation.

Keywords

Epidemic Situation; PLC; Virtual and Real Integrated Teaching.

1. Introduction

During the epidemic, the Ministry of Education put forward the teaching goal of "non-stop teaching and non-stop learning". Teachers adopt different online teaching models to ensure teaching progress and teaching quality during the epidemic. In order to minimize the impact of the epidemic on teaching, many school teachers mostly rely on platforms such as WeChat and Tencent conferences to carry out online teaching, and use the "Learning pass" platform to produce a variety of materials for students to use before and after class. After a period of practice, online teaching has been carried out smoothly, but it has also encountered a lot of problems. Especially in the teaching of PLC applied courses, only relying on online teaching can not guarantee that the teaching progress and the overall teaching quality can be completely controlled. Through virtual simulation technology and online teaching resources, this paper makes use of PLC cloud platform to carry out virtual and real integrated teaching during the epidemic, and achieves better practical results.

2. The Dilemma of Online Teaching of Practical Courses

Courses such as PLC application are highly practical technology application-oriented courses, if there is no practical link, the teaching effect will be greatly reduced. In many electrical departments or related departments of undergraduate and higher vocational colleges, PLC and similar courses are often used as required courses for students to study. If the offline teaching is adopted, the project teaching can be carried out combined with the hardware resources of the PLC training room of colleges and universities, so that students can have the basic ability of analysis and design of electrical automation control system. If we use the resource library of other colleges and universities to learn, students lack the practical experience of PLC hardware equipment, and the more complex project applications with a variety of peripherals are even more difficult for students to understand. Due to the lack of real teaching equipment, the difficulties of students' interest in learning and the cultivation of innovative ability are greatly improved.

Courses such as PLC applications require rich and effective teaching interactions. Online teaching interactions are mostly carried out in the form of discussions, live questions, in-class

quizzes, online answers, and so on. It is worth thinking about how the teacher monitors the learning status of the whole class at a certain time and whether the students are doing things that have nothing to do with their study. Especially in such technical application courses as PLC, teachers are required to quickly grasp the difficulties of students' programming operation. How to judge that the whole class has completed a typical practical training task? How to judge whether the students' steps of operating the programming software are correct? If you rely on students to answer "done", "I know" and so on online, it is obvious that the teaching effect will be greatly reduced.

The simulation resources of PLC courses are not interactive and operable. In practice, due to many PLC models, fast hardware upgrade, many peripherals and a wide range of applications, simulation resources can not be updated in real time, and even many computers can not install PLC simulation software at all. For example, using PLC simulation software such as "FX-TRN-BEG-C" to let students operate, the software can not support the long-distance teacher-student interaction based on Internet, and can only try to let students complete the training and submit the simulation results to the homework area and discussion area. The overall effect of simulation training is relatively general. Therefore, the existing PLC simulation resources can not fully adapt to the teaching and learning of "the combination of reality and reality based on the working process, complement each other, whether it is necessary or not".

3. Specific Methods and Measures to Solve the Problem

3.1. Research and Build a Cloud Platform for Practical Training and Teaching

The platform adopts PLC S architecture mode, that is, using "hardware entity" + "management side" + "client" to realize the teaching of "combination of virtual and real based on working process, mutual supplement, ability and reality without need". The hardware entity is uniformly managed by the server and allocated to teachers and students according to their needs. In the process of practical training, data (such as soft component testing, etc.) are generated by remote actual PLC hardware, which is very different from the traditional PLC virtual simulation system. The platform has the functions of training room management, course management, personnel management, process management, system management and so on. The platform breaks through the space limitation, and the professional teachers of PLC courses can carry out teaching group management and student management in the distance, realize group cooperation, and complete simple to complex PLC training tasks; students can use the platform to remotely operate PLC hardware modules before, during and after class to see the real equipment status, such as whether PLC reports errors and whether the program runs reasonably. During the epidemic and any other appropriate time, teachers can assign equipment, monitor training equipment and score experimental results through this platform, and there is little difference between course management and offline. Take Mitsubishi FX5U PLC controller and its supporting GX Works3 as an example, through this cloud platform, PLC programs can be uploaded remotely and monitored. Students only need to complete the simple setup in the dormitory and other places. The first step is to open the debugging software. The second step is to set up "online" and implement "read from PLC". The third step is to select the remote PLC connection method "directly connect CPU". The fourth step is to select the network card adapter connected to the remote PLC on the computer and carry out a "communication test". If the communication is successful, you can use the PC remote PLC for program debugging and monitoring.

3.2. Developing Cloud Platform Teaching Based on the Principle of "Combination of Deficiency and Reality and Mutual Complement"

Through this platform, some problems can be solved, such as the lack of real operation of PLC, network stutter, unable to monitor the debugging process globally, and the combination of virtual and real. The virtual reproduction of real training links and positions can enable distant learners to obtain real PLC training environment and real equipment operation flow. Based on the distance training system based on Internet + mode, students can not only use the traditional PLC simulation resources available in the computer for training, but also conduct real hardware training with the PLC training teaching cloud platform; in addition, teachers can not only use the existing learning platform for live teaching, but also monitor students to complete real training based on the cloud platform, so as to improve the teaching effect of practical training. During the epidemic, take Mitsubishi PLC teaching as an example, students can identify themselves through the client, establish a communication link with the platform, and the platform allows students to log in to remote PLC to operate. There is no complex remote monitoring operation, students only need to focus on PLC programming. Students directly use Mitsubishi GX Works programming software to download, debug and monitor the ladder diagram remotely, allowing students to achieve a "zero" distance from the PLC training room. Combined with this platform, teachers can remotely monitor the process of students' training. Whether the PLC program design is wrong or not, whether the program debugging is successful or not can be displayed directly on the platform.

3.3. To Form Complementary Advantages with Cloud Platform through "Learning Skills"

3.3.1. Learning Situation Analysis

The teaching object of this course is sophomore major. The students have finished the courses such as Electrical Control and know the structure, principle and usage of typical electrical products. Students have also studied motor courses and mastered the principles of three-phase asynchronous motors and typical motor control circuits. However, many students' relay control circuits only train self-locking, forward and reverse on the drag board, and have general ability to install wiring, debug and troubleshoot complex circuits. Students have no intuitive understanding of PLC, so teachers need to eliminate students' strangeness to PLC in the first few courses of this course. These students are more resistant to the pure theoretical study of the basic knowledge of PLC, but are more interested in the learning way of combining theory with practice. Many students also hope to learn through this course to lay the foundation for becoming a technician in the industrial control industry in the future.

3.3.2. The Overall Teaching Strategy of the Project

According to the overall learning situation of the students, during the epidemic period, the course made full use of information-based teaching means and adopted the virtual-reality integrated teaching mode. Teaching depends on learning through APP, Mitsubishi GX Works programming software and other different resources, making full use of video, animation and other information means, combined with cloud platform applications, one by one to break through the important and difficult points of teaching. Teaching integrates the elements of "craftsman spirit" and the good quality of loving labor, closely combines the teaching process with engineering practice, and trains high-quality technical and skilled talents who can meet the needs of the application and development of new technology.

3.3.3. Teaching Steps before, During and after Class

Take "project-PLC self-locking control circuit" as an example. Before class: release and learn the contents of the corresponding chapters, including typical pictures and case videos of PLC applications, so that students can have a preliminary understanding of PLC. Teachers use the

existing resources such as short videos based on knowledge points to help students quickly understand the main knowledge points of this class, and teachers explain the important and difficult points pertinently. Then, through the classroom management software (such as LanStar, etc.) to issue in-class work tasks, work points, etc., the tasks assigned have task decomposition and reflect the gradient of the task. The group leader makes full use of the respective advantages of the team members and assigns tasks to the team members through the group. Under the intentional guidance of the teacher, the preparation is completed quickly before work, and the students immediately begin the study and practice of the project. Therefore, for PLC courses, each project involved in the course puts forward knowledge and skill requirements, paying attention to the application of classroom discussion and engineering manual, so that students can have a clear purpose in each training, so that students can connect knowledge points and skill points in the process of training, so that the effect of training can be greatly enhanced.

In the class: first, the use of teacher enterprise work experience, combined with learning through APP and other information means to introduce PLC typical enterprise actual combat cases. Through pictures, videos and other resources to assist teaching, to help students understand the basic structure of PLC and the typical soft components of PLC, so that students do not feel strange to PLC, and have the willingness to learn it further. The second is to carry out practical exercises based on the PLC cloud platform, so that students can complete PLC programming, download and monitoring without PLC around them, and students can achieve "remote hands and brains", see Fig.1. Third, combine online resources and cloud platform to break through knowledge difficulties. In the above project 1, the knowledge difficulties mainly include "how PLC works". In order for students to really understand this knowledge point, we should not only make full use of resources such as short videos, but also design online teaching blackboard writing, and let students download a typical program directly through the cloud platform, so that students can understand the working principle of PLC cycle scanning. Let the team communicate, summarize the gains and losses of the task, organize documents, if time permits, let the student team report online, and teachers comment and summarize the groups. In this process of work, it not only exercises the students' ability to work independently, but also strengthens the students' sense of teamwork.

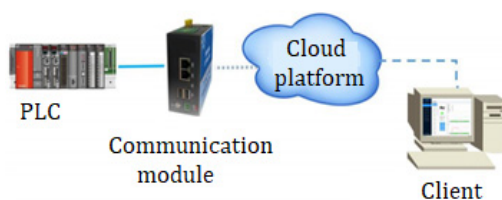


Fig 1. Carry out practical exercises based on PLC cloud platform

After class: assign homework through "Super Star Learning Link", arrange the preview content of the next class, and provide micro-video of course teaching points, so that students can master the learning methods of this course as soon as possible. Let the team communicate, summarize the gains and losses of the task, and organize the documents. In this process of work, it not only exercises the students' ability to work independently, but also strengthens the students' sense of teamwork.

4. Practical Effect

Improve teachers' information-based teaching ability. With the combination of PLC cloud platform and online teaching resource database to teach PLC application courses, teachers have become helpers and partners of students' learning to a certain extent. The online distance

between teachers and students has been shortened, so that students feel that class is interesting and learning is not boring. A good teacher-student relationship also promotes the improvement of teachers' teaching ability. For example, when talking about some important and difficult knowledge, we use resource videos, enterprise cases, cloud platforms and so on to assist the explanation, so that students can quickly accept these contents. On the other hand, students will not be afraid of the classroom, especially during the epidemic, so that students have a strong subjective willingness to learn practical courses. Systematically plan the course teaching content according to the post requirements, face up to the current learning situation of professional students, proceed from the diversity of resources and materials, proceed from the specific application of project teaching, reduce students' fear of difficulties in learning PLC courses, explore a new mode of online practical course teaching based on cloud platform, and improve teachers' professional course project teaching ability.

Students are willing to use their words, hands and brains in class to improve the quality of teaching. Students have something to see in class, they are willing to do it, they have the opportunity to do it, and they are willing to communicate with teachers. Let students learn in activities, experience and discover problems, solve problems, and experience the process of inquiry learning. After class, it is convenient to use a variety of teaching resources provided by teachers for learning, reducing the difficulty of after-class learning and self-study.

Let the students' intelligence and non-intelligence factors get double development through the process assessment. The traditional assessment includes peacetime score, training score, paper score and so on. Due to the integration of virtual and real training based on cloud platform, the evaluation process can be realized by software, which is efficient and intuitive. PLC course teaching not only attaches importance to the cultivation of students' engineering application ability, but also emphasizes their professional consciousness and team spirit. In the course teaching, students' feedback information can be quickly displayed through online teaching, and online teaching attaches great importance to all kinds of student feedback information (including suggestions, etc.). Therefore, online teaching should also guide student groups to evaluate the cooperative learning process and learning effect in various ways. The way of process assessment is used to comprehensively evaluate the students' learning process and learning results in the course, which is based on students' development and pays attention to both the learning results and the learning process. Pay attention to the dual development of students' intellectual and non-intellectual factors, so as to achieve the teaching goal of "cultivating not only a certain knowledge reserve, but also strong practical ability and good quality".

5. Conclusion

This paper explores and studies the teaching practice of the integration of virtual and reality on PLC cloud platform under the background of epidemic situation. This paper analyzes the teaching difficulties of PLC applied practical courses during the epidemic, and puts forward the idea of integrated teaching of virtual and real based on PLC cloud platform. Build a cloud platform, build online resources, and give a typical case of the integration of virtual and real teaching. The specific implementation methods and matters needing attention are described respectively before, during and after class. Through practice and exploration, teachers' abilities of information-based teaching, teaching and scientific research, and the production of resources have been greatly improved. Students can also acquire PLC application knowledge faster and better, and students also agree with this teaching method. The teaching effect of the course has also been tested in practice.

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