Research and exploration of practical teaching based on the online-merge-offline

Ping Liu, and *Min* Wu*

Ningbo Polytechnic, Ningbo Zhejiang 315800, China

Abstract. Practical teaching is an indispensable and important part of teaching in higher vocational colleges. In view of the COVID-19 Era, teachers and students cannot carry out on-campus and offline teaching activities, which reduces the effect of practical teaching. In order to effectively carry out online practical teaching, the use of micro-video and simulation software through a variety of teaching platforms and online live broadcasts, "replacing reality with virtual reality", increases the interaction between teachers and students, improves students' participation, and achieves students. "The process of knowledge learning-knowledge internalization-knowledge solidification" solves the problem of insufficient hands-on ability in online teaching of practical courses.

1 Introduction

Since 2020, in response to the COVID-19 Era, the Ministry of Education of my country has issued a series of measures and policies for "suspending classes without stopping school", and at the same time put forward the opinions on "doing a good job in the organization and management of online teaching in colleges and universities during the epidemic prevention and control period". Facing the current characteristics of frequent small-area communities, online teaching is no longer optional, but a problem that must be considered in each course. my country is the first to usher in the era of online-offline full integration[1-2] (OMO is Online-Merge-Offline), making the boundaries of online and offline teaching more blurred. The use of blended teaching in the pre-class, in-class, after-class teaching links, and even the practical links, so as to organically combine online teaching activities with offline teaching activities, in order to achieve the goal of cultivating high-skilled and high-quality vocational talents.

Affected by the COVID-19 Era, teachers had to change the traditional teaching mode and adopt the online classroom mode. However, due to the lack of online teaching experience and understanding of online teaching, they directly moved the traditional teaching method to online teaching. In the face of network lag, network speed, and the limitation of computer hardware conditions of teachers and students, the communication and interaction between teachers and students has been greatly affected. Completely online" teaching mode. Due to the limitation of experimental conditions, practical teaching has become the bottleneck of online teaching.

* Corresponding author: 52599570@qq.com

2 Problems in practical teaching under the epidemic

Because the practical courses mainly rely on the school's laboratory equipment, through teachers' explanations, demonstration operations, and students' imitation, the method of "learning by doing and learning by doing" adopts a progressive multi-cycle project-driven teaching method. Projects range from simple to complex, from easy to difficult, following the law of career growth and cognition. For core skills, repeated emphasis and training in each module, training students' vocational ability and engineering implementation ability. However, during the epidemic, teachers taught online and students studied online. Neither students nor teachers could carry out normal teaching activities in the school's laboratory, and there was no real experimental equipment to operate. As a result, many practical courses cannot complete the original teaching tasks, and students' hands-on ability is greatly shackled.

In addition to the limited experimental conditions, the impact on practical courses also has the following problems.

2.1 Lack of teaching resources

Because the experimental equipment (such as software environment, computer hardware conditions, etc.) and experimental environment of practical teaching take the school's instruments and equipment as the carrier, students practice through teachers' teaching principles and demonstration operation, so as to master knowledge, acquire skills and realize the internalized experiential learning of knowledge. During the epidemic period, students and teachers could not carry out routine offline teaching and could only use online teaching. Many teachers could not carry out webcast in online teaching. Some practical links could only be suspended and changed to theoretical teaching, which could not achieve the goal of offline teaching.

2.2 Changes in teaching methods

Practical teaching adopts the teaching mode of "learning by doing, learning by doing" with real equipment as the carrier. Because there is no real equipment, students can only teach through teachers, lack of practical environment, and cannot improve their practical ability through real experience. Make it difficult for students to adapt to online practice.

2.3 Difficulty in organizing teaching content

Due to individual differences among students and different receiving abilities, it is difficult to unify the progress of online practice teaching, and the problems arising in experiments cannot be controlled in time, which brings great challenges to the organization and design of teaching content. Improper settings can easily cause some students to fail to complete the task within the specified time or to complete the task ahead of schedule.

2.4 Changes in teaching methods

Offline teaching mostly adopts the method of "teacher's explanation, demonstration operation, and students' imitation", while online teaching lacks the on-site control and restraint of teachers, and it is difficult for students who are not self-disciplined to become the original teaching task.

2.5 Teaching interaction is limited

Online teaching breaks the traditional face-to-face teaching method. Although many online live broadcast platforms (such as Ding Talk Video Conference and Tencent Video) have also added interactive functions, they cannot be played back. Once students experience network freezes, It is impossible to replay and learn again. At the same time, due to the different network environments of teachers and students, network delays, students and teachers are out of sync, and the interactive functions are greatly limited, which makes some students unable to digest and absorb what they have learned in a timely manner.

2.6 Inaccurate teaching evaluation

Due to the limitation of environmental conditions, it is impossible to track the students' learning process in real time. Many students do not pay attention to the online practice link. As long as they hang up online, they can get good grades as long as they submit homework, so that the teaching evaluation of practice is not true and accurate.

In response to various problems in online teaching in the above practical links, many schools have proposed new teaching methods and concepts, such as: online and offline laboratory teaching modes, management methods, interactive methods, teaching methods, evaluation methods, etc. Innovation [3-5].

3 Solutions and measures

Under the educational background of the OMO Era, the professional teaching team of mechatronics of Ningbo Vocational and Technical College actively explored the teaching mode of "full online and offline integration", which changed the traditional teaching mode with students as the main body and teachers as the leading. Taking "PLC Technology and Engineering Application" as an example, the online teaching, video recording, programming software of Mitsubishi system, simulation software and other teaching methods are reasonably used to explore the network of practical teaching. Design an efficient "fully online" teaching case that conforms to the teaching rules. A new method is proposed for the online teaching of the SFC function module of the Mitsubishi system, "combining the virtual and the real, and replacing the real with the virtual" to make up for the lack of offline practice during the epidemic.

A fully integrated online and offline teaching method is adopted. Before class, let students preview before class through PPT, learning task list, project materials, micro video, etc. provided in online teaching platforms (such as cloud class, MOOC, vocational education cloud, etc.) In the class, teachers conduct practical teaching drills, and through online explanations, students will answer the questions interactively, so that every classmate can participate in the teaching, arouse the enthusiasm of the students, and let the students take the initiative to participate and actively integrate into the teaching. Transform the teacher's "teaching demonstration" into the student's "active learning and active participation"; the teacher's "class explanation" becomes the student's "cooperative inquiry" to solve problems together. This teaching mode closely links teachers and students through the network, and provides students with a real sense of practical teaching by operating simulation software, which makes up for the lack of online teaching resources. After class, conduct online discussions, answer questions, evaluate, complete and organize task lists, submit homework, study the content of the next task, and prepare for the next class. The specific design scheme is shown in Table 1.

Table 1. Curriculum design scheme.

Learning phase	Learning method	Network Platform and Software	Learning Content
Before classes (knowledge learning)	problem import, Goal-oriented, Self-learning	Cloud classes, MOOC resources, vocational education cloud, network resource library	1. Loose-leaf textbook 2. Study task list 3.PPT, micro video
in classes (knowledge internalization)	class interaction, group discussion, Project combat	DingTalk live video, practical teaching software, simulation software	1. Project actual combat 2. Cooperative inquiry 3. Achievement display
After classes (Knowledge solidification)	Comprehensive evaluation, Consolidation after class, analysis Summary	DingTalk, QQ,WeChat	1. Online discussion 2. Online Q&A 3. online reviews

3.1 "Replace the real with the virtual", combined with simulation software

Use the GX Developer programming software of the Mitsubishi system and the FX-TRN-BEG-C simulation software provided by the Mitsubishi Corporation for linkage. The teacher recorded the installation methods of the two softwares into micro-videos for students' reference. Under the guidance of the micro-videos, the students installed them on their own personal computers, and they could perform simulated operations through the virtual environment and human-machine interface provided by the manufacturer to achieve "The effect of substituting reality for reality.In the practice of the real course, according to the requirements of the project, students choose experimental equipment by themselves, such as: PLC model, electrical components (input devices such as travel switches, buttons, sensors, etc.; AC contactors, indicator lights, solenoid valves and other output devices) device). Determine the number of I/O points, compile the I/O allocation table, draw the PLC wiring diagram, and design the SFC sequence function diagram. The ladder diagram is compiled through the GX Developer programming software, and then written into the PLC to run after conversion, so as to realize the requirements of the movement of the motor, the specified lighting, and the movement of the solenoid valve.

In the online teaching, since there is no real equipment, it is necessary to use the FX-TRN-BEG-C simulation software to realize the above functions. However, because the simulation software has been matched and the experimental equipment has been solidified in the software according to different projects, there is no need for students themselves. Selection, I/O point assignments are adjusted according to the requirements solidified in the simulation software, as shown in Figure 1.

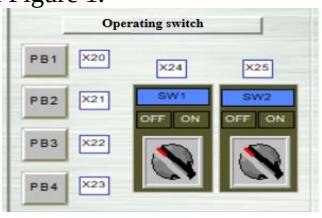

Fig. 1. I/O point curing of simulation software.

When programming GX Developer, according to the fixed I/O points, write the I/O point allocation table, draw the PLC wiring diagram, compile the SFC sequence function

diagram, and then convert it into a ladder diagram, and then import it into the simulation software. By operating in the simulation software, you can simulate the real action scene. To achieve the purpose of students' practical ability.

3.2 Record micro-videos to achieve "learning by doing and doing while learning"

Combining of programming software and simulation software, the teacher team integrates and sequenced the teaching content, from simple to complex, from single to comprehensive, and designs multiple teaching projects that conform to students' cognitive laws. Record a 3-5minute micro-video of the teaching project. The video includes the operation steps, methods, processes, etc. that students must master. In order to facilitate students' learning and viewing, the micro-videos are accompanied by text narration and audio commentary. Teachers upload micro-videos to the online platform for students to study independently before class, assisted learning during class and consolidate review after class.

After passing the teacher's theoretical explanation, students use the method of repeatedly watching micro-videos to imitate the teacher's operation process to practice, so as to achieve the purpose of "learning by doing and learning by doing", and then make up for the lack of real equipment in online teaching.

3.3 Form a team and select teaching content

The full-time teachers and the part-time teachers of the enterprise are formed into a curriculum research team. The team consists of full-time teachers, including senior teachers with rich teaching experience and more than 10 years of teaching experience, doctoral degree within 3 years of graduation and more than 1 year of practical experience, and more than 10 years of enterprise frontline Adjunct faculty with work experience consists of three types of faculty. Teachers with high professional titles have rich teaching experience. Through systematic analysis of students' cognitive characteristics, emotional characteristics, willpower characteristics and behavioral characteristics, they have a full understanding of students' learning situation; young teachers have high academic qualifications and understand the latest preface Technology, processing information fast, familiar with various network teaching methods and means; part-time teachers, have a thorough understanding of the history of the industry, and the needs of the industry are clearer. The three types of teachers have their own specialties, and jointly conduct research on teaching content, methods and means. Through the analysis of students' cognitive laws, enterprise needs, and network teaching methods, according to the practical characteristics of the course, the teaching content is determined to improve the practicality and professionalism of teaching.

In order to extract suitable teaching content, the team organized Haitian Precision, Ningbo Iron and Steel, Lilong Group and other enterprise technicians to jointly analyze typical work tasks, work processes and professional abilities with the school's teaching team. According to the job requirements such as PLC programming, debugging, maintenance and after-sales service, the school-enterprise cooperation forms a course project based on the combination of theory and practice based on the work process according to the process of "professional ability analysis - ability target determination - teaching content sequence". Teaching with real cases in business and life.

3.4 Mixed use of platforms to improve classroom binding

Multi platform mixed use shall be adopted before, during and after class to develop strengths and avoid weaknesses. Pre class notice: use QQ platform to release information,

make each student become an informant through password red envelope, and quickly transmit the information to each student. Pre class file release, micro video, courseware, etc. of cloud class platform; In the class, the advantage of convenient data export of cloud class platform is used to sign in for class, add project activities, submit class homework, and nail video conference. The functions of screen sharing and online wheat connection are supported for effective interaction and online monitoring. Through the screen sharing of students, we can grasp the learning progress and dynamics of students in real time, play the role of on-site control and restraint, and let the students who are not self disciplined be restrained; After class, use cloud class to submit homework, comment, teacher-student interaction, etc.

3.5 Connect a microphone rushing to answer, enhance the interaction between teachers and students

In class, when using the Ding Talk platform to teach, after asking questions, the teacher asks students to answer the questions through connecting a microphone, and the students who are in connecting a microphone can share their answers through the screen, and teach the class to the students who are actively answering. Add points to improve students' enthusiasm for classroom participation.

3.6 In-class test to improve evaluation accuracy

In the class, set a certain number of multiple-choice questions for key content and error-prone knowledge points, conduct random tests during the class and limit the answering time to avoid students hanging up online, and check the students' answers through data statistics. The situation and the correct rate of the questions, quickly understand the students' mastery, and adjust the course progress in time according to the feedback. After class, teachers arrange interactive Q&A sessions to communicate and discuss with students on the cloud class platform to make up for the lack of one-to-one communication due to limited classroom practice. Effectively communicate with students through corrections, comments, messages and other forms of homework after class, and individual guidance to achieve the best teaching effect.

4. Analysis of the effect of course implementation

Through the three classes of electromechanical 3201, 3202 and 3203 of the mechatronics technology major of Ningbo Vocational and Technical College, a total of 132 questionnaires were distributed, and 122 valid questionnaires were received. The results of questionnaire statistics show that 92% of students believe that the use of simulation software to assist teaching can make up for the lack of online practical teaching (Figure 2), and achieve the effect of offline practical teaching to a certain extent. In addition, students also encountered the following problems during the epidemic, such as unstable network, inappropriate family environmental conditions, unsupported equipment, insufficient self-control ability of students, inconvenient use of the platform and so on.

The results of the above questionnaires show that teachers use the combination of programming software and simulation software, and through the comprehensive application of "replacing reality with virtuality", mixing multiple teaching platforms, online connection of microphones, and classroom testing, students can pass the learning task list. , courseware, micro-videos, etc. for pre-class preview; in-class learning through online explanations, continuous microphones, and online tests; as well as online discussions and answering

questions, and after-class learning by submitting homework. To a certain extent, it can solve the bottleneck of online practice teaching and make up for the problem of insufficient online practice teaching.

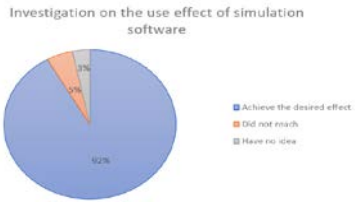

Fig. 2. Investigation on the use effect of simulation software.

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