

## Application of PBL Teaching Mode in Cloud-Based Teaching

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### Abstract

PBL teaching mode is adopted in online experiment teaching. In the teaching, the experimental content is divided into specific problems, which are released to students in three stages before, during and after class, the ways of solving problems and discussing problems, solving corresponding problems and completing the experimental content. PBL teaching mode realizes the partial transformation from "Teacher centered" to "student centered" through the ways of students' independent learning, group mutual learning, group cooperation, group mutual evaluation, group mutual evaluation and teacher evaluation. Taking the experiment of "the working principle of fluorescent lamp and the improvement of power factor" as an example, this paper describes the specific implementation process of PBL teaching mode and the test, measurement and evaluation method. Thus, it provides a useful reference for solving the problem of students' hierarchical guidance, learning process management and evaluation, and serving students' learning process.

### Keywords

PBL teaching mode; Cloud-based teaching; Experimental teaching.

### 1. Introduction

During the epidemic period in 2020, colleges and universities have made corresponding measures and arrangements to "stop class but not stop teaching, stop class but not stop learning". The epidemic situation makes students unable to return to school, which forces teachers and students to use the application virtualization software platform (cloud) for online teaching, that is, cloud-based teaching.

Teachers can take live, recorded, rain classroom, MOOC and other ways to teach online, but for practical courses with strong applicability, how to carry out online teaching, how to design teaching courseware, how to carry out teaching interaction, and how to receive and master students? This is a common problem for teachers and students. Practical courses are closely related to theoretical courses. It is an important link of integrating theory with practice, training students to master scientific methods and improving practical ability [1].

Online teaching is not simply to move offline classroom to online; it needs to apply online simulation, virtual reality, virtual practice and other technologies in the teaching process [2]. Only when the educational technology and teaching design are deeply integrated can the teaching effect be improved. The key to the success of online teaching is to guide students to study independently and solve problems in the form of group cooperation. Online teaching forces students to learn independently and students will actively establish contact and cooperation with their peers to solve problems, which coincides with PBL teaching mode. For teachers, PBL teaching method just shows the knowledge points in the form of questions.

Teachers assign tasks to students in the form of questions, so as to realize the integrity of the knowledge system. In this paper, the practice of "comprehensive design of curriculum" as an example, based on the PBL teaching mode online teaching development, implementation process and learning process management and evaluation problems, put forward countermeasures and suggestions.

## 2. Cloud Experiment Development

### 2.1. Multi Resource and Multi Platform Alliance

In order to achieve high-quality online interactive teaching, online practice teaching comprehensively uses various forms such as intelligent teaching tools, online interactive tools and MOOC resources, and realizes the joint application of multi resources and multi platforms. Online teaching makes the physical classroom "Teacher centered" into "student-centered", and makes the teaching process into the form of "resource design + resource production + learning support services", forming the activities supported by multiple resources, multiple platforms and different stages. At the same time, it needs the cooperation of teachers and students. Using MOOC, we use the national virtual simulation experiment teaching project sharing platform; schools and schools, schools and enterprises establish contact; open the virtual simulation teaching cloud platform and cloud desktop during the epidemic; build a rich online teaching practice platform; and establish a college experiment teacher exchange group, to provide guarantee for the smooth development of practical courses.

### 2.2. PBL Online Practical Teaching Mode

**Table 1.** PBL online practice teaching mode

Problem driven			
	Independent study before class	Intensive lecture in class	After class Q & A Discussion
Learning supervision	1. Group formation, assignment of responsibilities and obligations of team members 2. Publish team tasks	1. The teacher explained the key points and difficulties of the experiment, demonstrated the operation process, and pointed out the precautions. 2. Group experiment, complete the assignment. 3. The teacher divided into groups to comment on the experimental group.	1. Students answer the questions in the experiment and hand in the experiment report. 2. The teacher read the report and pointed out the problems.
Learning tools	Textbook, MOOC, virtual simulation experiment cloud-based platform	Tencent conference, rain classroom, super star learning APP, virtual simulation experiment cloud-based platform	WeChat, super star learning APP, virtual simulation experiment cloud platform
Learning content	<u>Learning objectives</u> <u>learning tasks</u>  Participate in assessment	1. The experiment circuit is designed according to the realization principle and platform condition 2. The problems and differences between the experimental theory and the practical operation	1. Complete the experiment report 2. Preview Next time 3. Help each other within the group and evaluate each other among the groups
Learning subject	<u>Self study</u> Promote learning in groups and supervise learning between groups	Teacher led learning	Mutual learning Teacher commenting

PBL teaching mode is a teaching method guided by problems, and is an education method regarding students as the center [3]. PBL teaching method, also known as problem driven method, has five characteristics, that is, starting from the need to solve a problem; students carry out the problem in this situation; in this process, teachers and students cooperate to find solutions; learning technology builds a problem-solving scaffold for students to improve their ability; finally, students get the results of problem-solving and openly share learning achievements. The PBL teaching mode is shown in Table 1.

### **2.3. Implementation Process**

Before online experiment class, teachers need to publish classroom behavior norms of online practice class on the teaching platform and WeChat to create a harmonious and loose online experiment atmosphere. Before and after class, teachers timely upload lecture notes, live playback, expand resources, learning links, etc. for students to learn, review and self-study. With the help of learning platform, teachers release a few basic and improved exercises, and set a certain answer time cut-off point to urge students to self-study.

#### **2.3.1. Independent Study Before Class**

In the practical teaching, students are required not only to know the relevant theoretical knowledge, but also to practice on the virtual simulation platform. Therefore, the preparation workload of online practical teaching is much larger for teachers and students than offline practical teaching. In the pre class phase, teachers need to debug the management end, teacher end and student end of the virtual simulation platform to ensure the interconnection communication among the three, as well as the normal installation of the experimental environment and the normal operation of the software. Students need to master the installation method of the experimental platform environment, the installation method and use method of the experimental platform software. The content of this link, students can only continue to practice, learn from each other and communicate with teachers in time, in order to ensure the smooth progress of the class.

Practice teaching is different from theory teaching. In theory teaching, teachers have a relatively long time to explain knowledge points. In the online experiment teaching, if the teaching time of theoretical knowledge related to the experiment is too long, it is easy to distract students' attention; if the teaching time is too short, students will have difficulty in understanding. Therefore, the pre class guidance link of practice teaching is very important. In this link, students can combine the theoretical knowledge learned with the related content of practical operation through the audio and video explanation of relevant knowledge points such as target guidance, teacher push and other related knowledge points, so as to realize the goal of integrating theory with practice.

#### **2.3.2. Intensive Lecture in Class**

The best way of online practical teaching is for teachers to conduct live explanation and operation demonstration around the key and difficult contents, characteristics of virtual simulation platform, practical operation items and other contents of practical activities. Take 8-10 minutes as a section, and divide it into 2-3 sections to complete the explanation content. In the rest of the time, the teacher enters the group regularly for patrol and online Q & A. Because the students have preview the practical content before class, and have designed the circuit, so the knowledge points and the practical content designed by the students can be presented alternately in class, which can be integrated into the students' questioning, discussion and design display activities. For simple verification activities, students can explain the principles online. Through the teacher's questions to the students, the group members cooperate to answer the questions. During the students' practice, teachers collect students' feedback in real time and answer questions before the end of the lecture. When there are not many questions, teachers can answer them one by one; when there are many questions,

teachers will choose key points to answer in class. After class, teachers will answer all students' questions and organize them into documents or videos to share with students. Compared with the theory class, the practice class has more forms of information transmission. Students can also post, discuss and comment on each other on the learning platform during the practice class. Teachers can also participate in it and guide students' discussion direction correctly.

### 2.3.3. Q & A Discussion After Class

After class time is relatively abundant, students can carry out asynchronous classroom discussion. For practical thinking problems, students can learn and discuss interactively with the help of network resources, which is conducive to promote students to reflect on the difference between theoretical knowledge and practical operation, and provide a way and method for learning to construct knowledge system. After class, teachers and students can use the PBL function of super star learning APP platform to realize students' works display, intra group evaluation, inter group evaluation, discussion and other activities.

## 2.4. Measurement Evaluation

The PBL evaluation standard [4, 5] of online practical teaching can carry out multi-dimensional, whole process and three-dimensional examination on students according to the PBL project provided on the intelligent learning platform. The students' practical achievement is composed of three parts: intra group evaluation, inter group evaluation and teacher evaluation. In group mutual evaluation, the members of the group are evaluated. After the group is established, the responsibilities and obligations of the members are designated to avoid the occurrence of "truant students". When assigning tasks to group members, each group has a team leader, questioner, reporter and recorder. After the task of team members is detailed and decomposed, it is released through the learning platform. The mutual evaluation between groups is carried out from the works display, circuit design, explanation and thinking question answer. Teacher evaluation is to guide the evaluation within the group and the mutual evaluation between groups, so as to make the evaluation as objective and fair as possible. The rules of intra group evaluation and inter group evaluation issued by teacher accounted for 80% of students' scores. Students attach great importance to their grades and can take them seriously when grading other students.

PBL project can be used to carry out hierarchical teaching of students, that is, students with strong learning ability propose to build their own practice content after completing the online practice tasks provided by the simulation platform, and teachers can guide their learning. For the students who are difficult to complete the online practice task, the demonstration video of practical operation is provided, and the students' mutual assistance is arranged to help complete the practice content. PBL project provides students with personalized education evaluation, which integrates teachers' evaluation of students' learning ability, promotion and improvement".

## 3. Teaching Implementation

### 3.1. Tasks and Activities

In order to prevent the single teaching method and mode, the teaching team members use mind map to release tasks to students and explain the activity mode, so as to make the self-study content and group task clear.

Independent learning before class is the content that all students need to complete. Group tasks should be assigned according to students' abilities. The key and difficult problems are assigned to the students with higher scores, the problems closely related to theoretical knowledge are assigned to the students of medium level, and the problems with less difficulty coefficient are assigned to those who are unwilling to think with their heads or do not want to practice.

The group tasks assigned by the teachers are assigned according to the different members of the group, and encourage the cooperation among groups, so as to make each group move as much as possible, so as to ensure the smooth progress of the activities in class.

### **3.2. Supervision and Evaluation**

The main feature of PBL teaching mode is to decentralize the students, and the leading role of teachers is highlighted when problems arise, which can be targeted to solve problems. When the practical measurement evaluation method is used to assess the group and its members, the weight of teachers is weakened. The proportion of inter group and intra group mutual evaluation is the same, which makes students feel that they are both the makers and executors of rules. In the mutual evaluation, most students are objective and fair. For individual "no attitude" students, the teacher through diligent supervision, more communication, and cooperation with counselors and parents to conduct psychological guidance, so that students in the mentality change.

During the online practice teaching period, when the team teachers launched a questionnaire survey on the "Evaluation table of practice achievement composition" to nearly 900 students taught by the super star learning APP platform, the students' satisfaction rate was 35.1%, and the relatively satisfactory rate was 32.6%. In other suggestions of the questionnaire, the students proposed to use the group method to increase the frequency of teacher-student interaction and improve the relationship between teachers and students; the use of learning platform software, WeChat and QQ and other media software to communicate with teachers is not limited by time, which enriches the content of teacher-student communication and shortens the distance between teachers and students.

## **4. Teaching Summaries**

PBL online practice teaching mode can arrange practical tasks for students, such as installing virtual simulation platform and practical operation software. These tasks are not only challenging, practical and research-oriented tasks for students, but also operational, achievable and mutual assistance tasks, which lay a good foundation for students' subsequent cooperation and learning within the group. It can promote the group students to actively think, explore and apply the knowledge they have learned to carry out the practical activities of the experimental project.

### **4.1. Design Tasks and Determine the Expected State According to the Learning Situation**

During the epidemic period, students complete their tasks at home. Therefore, teachers are required to design tasks that can promote students to think, explore and comprehensively use the knowledge they have learned to solve problems, which is challenging and contains good value orientation. When assigning and designing tasks for group members, teachers should also take into account students' family conditions, students' learning characteristics and their own abilities, etc., so as to provide students with certain assistance tools and guidance manuals. After assigning tasks, teachers must add additional expectations to the group according to the actual situation of the group, so as to strengthen the confidence of the team members to complete the task. According to the task content, the team can submit the work in the form of document, mind map, video and other forms. The task issued to students is not only to enable them to complete the corresponding learning tasks, but also to stimulate students' interest in learning in this way.

## 4.2. Announce the Task of the Team and Let Everyone Know

The tasks issued to students should be visible to all the staff. Students will compare and communicate with each other on tasks, and sometimes exchange tasks. The task released should make students feel that the task can be completed, but it is still a little difficult. The tasks to be published should be specific and clear, so that students can understand what they are submitting, such as assignments, works or other forms. After a period of online teaching experience, it is concluded that the deadline of the task should be released at the same time when the task is released, and the completion time should not be too long or too tight. According to the teaching content, the group can determine the deadline by itself.

## 4.3. Effective Learning Support

After releasing tasks to students, teacher should provide students with self-learning resources, works, examples, etc., so that students can have learning direction and goals. At the same time, teacher should regularly follow up and check the tasks at different time nodes by using QQ, WeChat and group Tencent meeting video. Teacher and group members have thematic discussions, live Q & A, case comments, and sharing process achievements, so that students can communicate with teachers and get effective help if they encounter any problems during this period.

## 4.4. Effective Intervention and Group Management

According to the previous experience of assigning students to groups, teachers need to intervene and manage the composition and management of group members to a certain extent. College students come from all over the country, and their own differences are great. Teachers should not only respect the establishment of their own groups, but also make appropriate personnel adjustment through the conversation of some students. Before the task is issued, the responsibilities and obligations of the team members shall be clarified, and the management of division, cooperation, sharing and evaluation shall be done well. Students are still very serious about their own group. After the task is given out, most students will complete the corresponding task with a positive attitude. A small number of students do not cooperate, teachers can only talk, psychological guidance and communication with parents to find solutions.

## 4.5. Timely Feedback

Teachers should also release the evaluation criteria for completing the tasks while releasing the group tasks, and set aside a period of time for students to put forward opinions and suggestions on the evaluation criteria, and adopt and implement the reasonable suggestions. The evaluation function of online platform task is used for feedback and the proportion of teacher evaluation, intra group mutual evaluation and inter group mutual evaluation is set to make the group score and students' individual score as objective and fair as possible. The excellent works of the group will be shared on the platform, so that more benefited students can "give a like or leave a message" and so on, so that students can keep a positive attitude to learn.

## 5. Conclusions

Using PBL teaching mode to carry out online practice is a new challenge and attempt for both teachers and students. The advantages are: (1) it is conducive to the cultivation of students' autonomous learning ability. Online teaching requires students to have strong learning ability and good learning habits, and students' autonomous learning ability must be improved to complete the learning task. At the same time, it also requires the ability of team learning, mutual cooperation and inquiry learning among students; (2) visual difference analysis. According to the data of students' learning ability provided by the learning platform, teachers can adjust the

teaching content in real time to realize the controllability of learning effect; (3) both teaching management and service should be paid attention to. It provides multi-level interaction such as detection, homework, examination, question answering and discussion, and provides guidance for students' personalized learning path. At the same time, the learning process management and evaluation of online practice teaching must be based on students' knowledge and consent. The design of online practice activities should conform to the form of students' characteristics, and can not completely copy the famous teacher's manual. Teachers and students to build a suitable interactive platform, establish a moderate evaluation mechanism.

According to the principle of generalized Le Chatelier, online practice teaching also makes us think about the teaching mode of practice teaching after the epidemic. Returning to school after the epidemic will put forward higher requirements for teachers. A series of contents, such as the ability to use modern technology, online and offline mixed teaching methods, curriculum development direction and practical curriculum development based on environment, will reshape teaching and improve teachers' ability again.

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