

Research on the Application of Project Based Learning Method in Equipment Operation Course

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Abstract—Being one of the most popular educational methods in the world, project based learning (PBL) method has been applied in the teaching process of many vocational schools at home and abroad. This paper studied the characteristics of PBL, combined with the current situation and characteristics of equipment operation teaching in military colleges, and analyzed the organization and implementation of equipment operation courses using PBL. The study of this paper has also supplied certain reference for carrying out the knowledge task of comprehensive skill mastery in combination with PBL.

Keywords—*Project Based Learning(PBL);Equipment operation; Practice teaching; Comprehensive ability*

I. INTRODUCTION

The course of equipment operation is a practical one for technical students in military colleges. The study of equipment operation course can increase students' ability of applying equipment theoretical knowledge, equipment practical operation and maintenance, and cultivate students' first working ability in the army effectively. Therefore, the teaching and study of this course is of great importance. But the students are often into the state very slowly because of the limitation of teaching conditions and the actual academic hour in implementation processes. And the combination of theory and practice can not be well which lead to the equipment operation stays on the surface of the maintenance rules. Usually, the teaching course is operated mainly addresses the provision of the maintenance operation of general outline. Firstly, the teacher will explain and demonstrate, and then the student will carry on the practice and operation. After learning the content, the students just stay at the level of doing, and can't combine the functional phenomenon with the structure and composition of the equipment and the working principle to gain insight into the reasons, thus failing to form an overall thinking to the equipment. Therefore, the graduates basically have no equipment troubleshooting ability. So the teaching effect is not so ideally as expected.

Project Based Learning is a new popular teaching concept in recent years. It has become one of the internationally popular educational methods. It is to develop students' comprehensive ability through the completion of a series of tasks and the realization of project goals. Over the past 20 years, all countries in the world have discussed and studied PBL. At present, many vocational schools at home and abroad

are actively exploring the application of PBL in the classroom. In order to better meet students' future job demands, it designs the content of teaching activities according to the content and requirements of typical work tasks, and organizes teaching according to or simulating actual work tasks, work processes and work scenarios. This teaching method is very suitable for the teaching characteristics of equipment operation course.

II. PROJECT BASED LEARNING

A. Definition of PBL

Based on the theory of constructivism, the method of PBL designs learning into an authentic task. Under the guidance of teachers, students take a relatively independent project as the teaching task and complete the learning of all teaching objectives in the process of completing this project.

The PBL method was germinated in the work-learning education in Europe in the 18th century and the cooperative education in the United States in the 19th century. It gradually became perfect in the middle and late 20th century and became an important theoretical trend. In 1935, Kilpatrick first proposed the PBL method, and considered that it was a whole-hearted, planned action in the social environment. In the following decades, the PBL method has been gradually developed and applied in the education fields of the United States, Germany and other countries. In 1968, Boddy and others summarized the development and application of this method at the stage from its significance, content, form and evaluation. Subsequently, the method was valued and applied in many countries around the world. Especially after the 1970s, the Steam Engine Project developed by Mercedes-Benz Automobile Company marked the rapid development of the it. In July 2003, the German Federal Vocational Education Institute developed an action-oriented project pedagogy that was applied in many universities. Since 1992, when Chinese educators proposed the PBL method, they have developed rapidly at different levels of teaching in China, especially vocational and technical education.

The most prominent feature of PBL is that it takes a project as the main line, students as the main body and practice as the basis. It has changed the previous teacher-oriented teaching mode and created a new one with students' independent learning, cooperative learning and research-based learning as the main body. According to the curriculum development department of Hong Kong education department,

project learning means that teachers and students conduct in-depth research on a topic related to real life together, which can be interdisciplinary. Its purpose is to enable students to construct knowledge system and cultivate students' attitude towards lifelong learning through the exploratory learning methods in a simulated environment. PBL method emphasizes that introducing learners into a real situation with life related topics. And the method is an effective strategy to improve traditional teaching and learning for its processing, which means with the guidance and designing to a driving problems, learners adopt group division of labor and cooperation, use science and technology as tools to explore and solve problems in a scientific way.

After summarizing various previous research results and combining with practical application, it can be concluded that PBL method is to give a relatively independent project to students to deal with by themselves under the overall guidance of teachers, including the collection of project information, the design of project program, the design of project implementation process and the final evaluation of the project. From the beginning to the end of the project, the students are responsible for themselves. Through the implementation of the project, the students learn how to solve the problems in the project through practice. PBL method is about how to implement the process, so that students can master every link in the process of project implementation, rather than how the project results.

PBL method emphasizes student-centered independent learning. Starting from trial and practice, it actively arouses students' learning initiative and creativity, enabling students to play the role of teachers and teachers to play the role of students, so as to realize the role exchange and make better use of students' independent exploration and problem-solving ability.

B. Characteristics Analysis of PBL

1) Practicality of the learning content

Combined mainly with practice, the project allows students to engage in and practice activities that cannot be realized in classroom teaching, and the practical is mainly reflected in the joint completion of activities between teachers and students. In the course of PBL, the method of project teaching is commonly used to integrate teaching content, and the content of teaching project is mainly evolved from the typical professional task. Breaking through the traditional disciplinary boundaries, the method of PBL regards project objectives as the core, and constructs the teaching content logically according to the working process of the project. Each student chooses different methods to solve problems according to its own knowledge, discusses independently, innovates actively, and gives full play to its subjective initiative to carry out practical activities.

2) Autonomy in learning process

The method of PBL has changed the passive learning mode of students. It is a mainly student-centered practice exploring teaching objectives actively, which is not caring about the results, but caring more about the participation of students in the learning process. Students are masters in the

whole process of project teaching from information collection, plan formulation, program selection, goal implementation, information feedback even to the evaluation of results

3) The Development of Learning Results

Dividing a long-term project into several short-term parts, so that it can regain knowledge and experience and even develop more projects in the process of gradual completion. The only correctness of learning results in project teaching is not what we want to pursue, for we want to focus more on the skills we have mastered in the teaching process, which is because that the standard of project evaluation to solve problems is not "right" or "wrong", but "good" or "better", and "improved" or "not improved". Therefore, the learner's outcomes are not unique, but open and diversified in project teaching.

4) Diversity of learning evaluation

The diversity of project teaching is mainly reflected in the evaluation methods, standards and subjects. In terms of evaluation methods, project teaching not only USES the traditional paper exam-oriented method to assess students' mastery of knowledge, but also emphasizes the methods used to complete the project, assess students' use of knowledge and skills, and the comprehensive quality to solve practical problems. In terms of evaluation standard, the absolute evaluation should be applied flexibly mainly to evaluate whether students have reached the goal and requirements of project teaching, and to care about the progress of students' application of knowledge and skills in project teaching, which is more conducive to the cultivation of students' professional ability, practical ability and innovation ability.

5) Exciting the teacher's creativity

The PBL method is a teaching strategy, and the teacher guides the students to carry out in-depth study of the real life things. This pedagogy has a flexible but more complex framework that indicates the characteristics of teaching and learning activities. When the teacher correctly implements the PBL, the students' enthusiasm for learning will be greatly stimulated, consciously learned and high-quality project completion. It has a complete system that requires teachers to be highly creative and adaptable. The specific implementation of the teaching plan requires temporary adjustments.

6) Promoting teaching reform

The citation of the PBL method can help teachers to implement the overall teaching and promote teaching research and teaching reform. The implementation of the project activities requires teachers to flexibly grasp the time and progress, carefully observe each student's learning progress and interest development, and master the characteristics of each student. And at the same time, correspondingly proposed or designed a teaching and learning program that not only develops individuality but also pays attention to overall balance.

PBL method and traditional teaching are not antagonistic, and their relationship should be organically combined and complement each other. Traditional teaching is the transfer of knowledge and skills, while PBL is to enable students to use the knowledge and skills from traditional teaching to

strengthen the memory and firmly grasp, while motivating and guiding students to learn and master new knowledge and skills. A good combination of PBL and traditional teaching can provide complete learning opportunities. The result of the PBL is that students not only learn a certain skills but also know when, where, and how to use it. Meanwhile, students learn to use it flexibly and can make a difference, and understand the role and significance of this skill. PBL is a part of teaching that allows students to participate in the arrangement of teaching plans and to help complete the teaching tasks of traditional teaching.

On the evaluation subject, students are encouraged to evaluate the learning results of the project actively and objectively, and students are encouraged to evaluate each other, by which learners can be improved to reflect on their own learning results.

From the above characteristics of PBL method we can see that using the macroeconomic regulation and control of this method to the whole process of equipment operation teaching is so reasonable and effective. Through PBL, every content of equipment operation course can be connected macroscopically, so that during the whole practice process, attention will be paid not only to details, but also to reflection that learners grasp of the skills and knowledge on the whole. Through PBL method in the evaluation we can see, it is worthy of study using this method on the equipment operation project teaching.

III. ORGANIZATION AND IMPLEMENTATION OF PBL METHOD IN EQUIPMENT TEACHING

A. Five Elements of the PBL Method

In processing the PBL method, we should pay attention to five important elements so as to achieve a perfect result.

Situational element. The first element of processing PBL in the contextual factor city is also one of the main tasks for teachers to implement project teaching. Due to the simulation of real events or which related to students' lives in different situations, different situations will lead to different problems and bring rich and colorful learning content, thus effectively mobilizing students to use original knowledge and experience to complete project tasks.

Task element. The PBL method is based on the original knowledge and cognitive structure of the characters. In order to complete a given project, it is necessary to arrange the learning tasks and learning time as a whole, and the overall design activities. The project task covers a certain amount of knowledge and should be developed for different teaching objects.

Organizational element: The most common and effective form of project pedagogy is group collaboration. This organizational form can effectively promote communication especially between students, and is also conducive to role-playing.

Process element. The process of learning cannot be limited to books, classrooms, and networks, but rather simulates the process of implementing an engineering project.

Resource element. According to the project's demand for resources, teachers need to use a variety of forms to organize a large number of effective preset resources and related resources, or to help students build and organize their own resources under the guidance of teachers.

B. Project Design

In the implementation process of PBL, the design and selection of project determine the success or failure of teaching. The teaching purpose of equipment operation course is to ask students to master the corresponding meaning, functional phenomenon and troubleshooting method through each operation clause. However, due to the limitation of class hours and conditions, students' operation in class mainly focuses on the complete realization of the whole operation process according to the operation steps, mastering the parameters and condition setting, getting familiar with the functional phenomenon and understanding the operation principle. If in-depth exploration is carried out, the significance of equipment operation is not only to enable students to learn to operate, but more importantly to understand the principle behind the functional phenomenon, so as to achieve the ultimate goal of eliminating operational failures. It is generally believed that excellent, practical and familiar projects can not only attract students' interest, but also enable students to have a sense of identity as early as possible, thus accelerating the transformation from theory to practice in the process of realizing project functions. The principles of project design for students are as follows. Firstly, the content of the project should be more relevant and practical to students' experience. Secondly, the project can cover most of the basic theoretical knowledge of operation and is easy to practice. And the last, it should be expandable to facilitate students to further learn equipment operation.

C. Project Implementation

According to the requirements of the project module, we reclassified and combined the teaching knowledge points required by syllabus, and divided the teaching process of the whole course into several teaching experiments, so as to form a new teaching and experiment implementation plan, which was carried out throughout the development process of the project. Before the beginning of each experiment, the teacher first explains the meaning of the maintenance provisions involved in the experiment, functional phenomena, parameters setting and demonstrates the operation. While conducting the operation training, the students have known the reason why each parameter basis was the condition setting. Beside mastering the basic requirements of provisions operation, the teacher will according to the provision of each one or several related operations to set up a number of experimental projects that equipment failure title issued to each group, let the students fully understand the purpose of the study, and understand that the experiment project learning task is to be completed personally, so as to stimulate students' interest in learning, improve the learning efficiency. Next, each team will start from the fault phenomenon, analyze the principle, look up the relevant circuit diagram, get the possible cause of the fault, design a kind (or several) of reasonable troubleshooting methods by the teacher's approval before implementation.

After troubleshooting, students are required to write a summary report, analyze and sort out problems in the implementation process, and summarize and improve various schemes.

From simple to complex, from easy to difficult, the whole teaching process will finally form a complete project by mastering each knowledge point one by one. In the whole experiment process, students will gain a sense of accomplishment and identity after completing a module for each task, and eagerly into the next module task of learning. With a strong interest and the exploration spirit of learning, students can not only complete the project and master relevant knowledge, but also help form a complete thinking and knowledge system for system design, and even process a certain capability for system application.

IV. CONCLUSION

The purpose of the PBL method is to use the real or simulated work tasks as the starting point, so that students can take advantage of various internal and external resources and their own experience to adopt the "learning by doing" approach. In the real or simulated work world, students participate in the work process in a multi-dimensional way, complete typical work tasks and during the course they can acquire knowledge and skills by completing work. In the process, they complete tasks, interact with teachers and classmates, gradually grow from a novice to an expert. We know that education is the foundation, and moral education is preferred. The PBL method has infiltrated the people-oriented thinking, fully considering the personality development of students, focusing on cultivating students' learning ability and study habits, emphasizing the development of students' professional habits and professional abilities, and cultivating students to form a lifelong learning concept. These learning abilities, study habits and professionalism will be a solid

foundation for their continued personal development and lifelong development.

PBL method is a perfect and effective teaching method combining theory and practice, which is worth to be popularized in the teaching of similar courses such as equipment operation practice. However, the research on PBL in China has just started, and the definition and characteristics of PBL are still in the initial stage of research. It is necessary to conduct in-depth research and discussion on PBL, especially in the comprehensive skills to grasp the knowledge task combined with the study of project teaching method.

REFERENCES

- [1] WU Liying. Practice of Project Teaching Method in the Teaching of Visual FoxPro Programming [J]. Modern Communication. 2017 *"In Chinese"*
- [2] WU Bingbing, JIN Xiaoyan, HUANG Hongyu, ZHAO Jie. Research on the Second Classroom Activity Based on the Teaching Method of Engineering and Learning Projects [J]. Health vocational education.2017. *"In Chinese"*
- [3] QIN Hongling, XU Xiang, ZHAO Meiyun. Application Research of Project-Driven Flipping Classroom Teaching Method in Mechanical Basic Courses [J]. Education and teaching forum, 2017(48). *"In Chinese"*
- [4] FENG Mingjia, XIN Zhixia. Discussion on the Teaching Method of Interchangeability Course Based on Project Teaching Mode [J]. Agricultural development and equipment. 2017(11). *"In Chinese"*
- [5] YANG Xue. Application of Project Teaching Method in the Teaching of Object-Oriented Programming Practice [J]. Computer age. 2017(07) *"In Chinese"*
- [6] TIAN Ke, LI Yuxia. Analysis of Domestic Project Learning Research and Development Trends[J], Inner Mongolia Education, 2013(12). *"In Chinese"*
- [7] LIYuxia, TIANKe. Discussion on the status quo and development of domestic project learning[J]. Jiangxi Education, 2013(33). *"In Chinese"*