

Application of PBL Teaching Mode in the Teaching of Building Electrical and Intelligent Disciplines

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Abstract

Problem Based Learning (PBL) is a new teaching model that starts from real problems in a complex world. This model takes students as the main body. Teachers design certain situations to link learning with real and poorly structured problems, so that students can generate and analyze problems independently in the situation, solve problems through learners' independent inquiry and group cooperation, learn to acquire the core knowledge of the subject hidden behind the problem, construct a knowledge framework, and then improve students' autonomous learning ability and problem-solving ability. This study attempts to apply the PBL teaching model to the teaching of building electrical and intelligent professional courses. It intends to take some professional courses of building electricity and intelligence as an example to explore the feasibility of PBL teaching, which can make up for the deficiencies of various teaching methods and promote theoretical and practical connection, improve the teaching quality, and promote the teaching reform of building electrical and intelligent major.

Keywords

PBL teaching mode; Building electrical and intelligent course; Application research.

1. Introduction

PBL (Problem Based Learning) is a problem-oriented and student-centered teaching method. In 1969, Barrows, a professor of neurology at McMaster University in Canada, introduced the PBL teaching method in the teaching of medical courses, and held group discussions around medical topics or the diagnosis and treatment of specific cases. process. In the 1990s, Europe began to introduce the PBL teaching method, and in 1997, the Faculty of Medicine of the University of Hong Kong implemented the PBL teaching method. In the 1990s, Chinese key colleges and universities began to introduce the PBL teaching method in basic medical courses, clinical courses and experimental courses, and achieved good results. Since then, the number of schools using the PBL pedagogy has gradually increased, and other subjects other than medical courses are also trying to apply the pedagogy. The building electricity and intelligence is a major in colleges and universities officially approved by the Ministry of Education in 2005. This major has been opened Southwest Jiaotong University Hope College in 2015. This major is highly cross-cutting and has a wide range of applications in society. As the proportion of intelligent buildings continues to rise, coupled with the transformation of existing intelligent buildings, the training of building electrical and intelligent professionals, especially the training of applied talents, should also closely follow the needs of social development. At present, there is some applied research of PBL teaching method in engineering majors, but there is no applied research in building electrical and intelligent majors. Due to the differences between majors, it is not suitable to copy directly. The application research of PBL teaching method in building electrical and intelligent majors has unique practical significance.

2. The Basic Elements of PBL teaching model

"PBL" is the abbreviation of "problem-based learning", also known as "problem-oriented learning". Foreign scholars and domestic scholars have different views on the definition of the concept of PBL. Based on their different perspectives and different emphases, some scholars understand PBL as a teaching method or learning method, while others understand PBL as a teaching model.

This paper believes that PBL is a teaching model, which emphasizes that students should be placed in real and meaningful problem situations. Students form a learning community to deal with and solve complex practical problems, so that the scientific knowledge can be learned from hidden behind learning problems. Under the PBL teaching mode, students form scientific thinking and master problem-solving skills to solve similar problems in the process of learning. Finally, this mode encourages students to flexibly master basic knowledge, develops high-level thinking skills, stimulates students' curiosity and inner learning interest, and promotes the development and improvement of students' autonomous learning ability, cooperative learning ability, problem-solving ability and discovery and innovation ability.

2.1. Constituent Elements

The PBL teaching model consists of three basic elements: questions, teachers, and students.

First, the starting point of the PBL teaching model is the question, which drives the entire learning process of students and inspires students to learn and think. Problem situations are at the heart of the PBL teaching model. The problems existing in PBL are unknown entities in a specific situation. In the process of teaching preparation, teachers fully consider the cognitive characteristics of students and the knowledge structure they already have, and pay attention to the scientific nature of problem design, so that problems can serve the teaching goal and pave the way for teaching content.

Second, students are the most important elements in the PBL teaching model. They are the main body of the classroom and people who are committed to solving problems. In the process of problem solving, students need to think closely in relation to their own life, pay attention to the combination of theory and practice, link existing life experience with unknown problems, and strive to use existing knowledge to explore the unknown question. After analyzing situational problems, they collect data and integrate effective resources, and focus on the reserves of existing knowledge structures and life background experience to find appropriate problem-solving methods and acquire new knowledge.

Third, teachers are one of the constituent elements of the model, playing a leading role in the PBL teaching model, playing the role of instructional designers and classroom facilitators. Students are the masters of the PBL classroom, but it does not mean that the status of the teacher is irrelevant and the role of the teacher is dispensable. Teachers, as designers of the whole course and facilitators of the classroom, create a comfortable and open learning atmosphere for students. Teachers should construct real problem situations, design appropriate problems, create an open and active classroom atmosphere, guide students in the problem-solving process, evaluate students' performance, and summarize and improve classroom results.

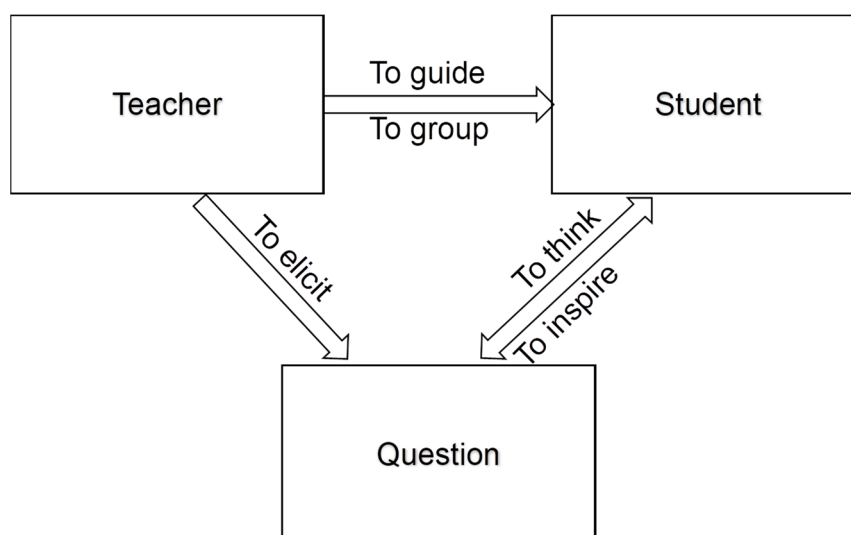


Figure 1. The relationship between the elements of the PBL teaching model

2.2. Implementation Elements

The PBL teaching model mainly includes four implementation elements: problem design, autonomous learning, group cooperation, reflection and evaluation. Problem design is the starting point of PBL implementation. A good problem situation can guide and regulate the entire learning direction and process, and effectively promote the formation of students' comprehensive thinking ability. Self-directed learning is the key to PBL. Students are responsible for themselves. They understand problems, analyze information, collect materials, and organize their ideas. They no longer rely on the fixed methods and standard answers given by teachers. Group cooperation is an important part of PBL. Students are in a learning community, and teachers and students communicate and inspire each other as equals. Reflection and evaluation are the sublimation of PBL. The evaluation methods show the characteristics of diversification and multi-subject, which adopts the combination of teacher evaluation, student self-evaluation and student-student mutual evaluation, qualitative evaluation method and quantitative evaluation method, process evaluation and summative evaluation. Under the guidance of teachers, students conduct classroom reflections and summaries to conceptualize the acquired knowledge.

3. Characteristics of PBL Teaching Mode

3.1. The Subjectivity of Student

Guaranteeing the dominant position of students in the classroom is one of the key goals of the current teaching reform. In traditional classroom teaching, the teacher is the main body of the classroom. The main form of classroom teaching is the teacher's explanation, the teacher instills the relevant subject knowledge, and the students passively accept the knowledge. The classroom under the PBL teaching mode takes students as the main body, so that students are no longer simply imitating and passively accepting, but self-constructing knowledge, and students become problem solvers and knowledge builders. The subjectivity of students is as follows: first, students have an independent subject consciousness, and can take the initiative to ask questions, think independently, and actively explore problems; second, students can exert their own subjective initiative to conduct self-regulation and self-control.

3.2. Implementation Elements

The problems in PBL teaching are complex and ill-structured problems in the real world. Generally speaking, they cannot be solved only by a certain knowledge point or using a certain discipline. Multidisciplinary integration and interdisciplinary integration are often required.

Students see the connections between various disciplines through the appearance of problems, integrate the knowledge points of various disciplines they have learned to form a new knowledge system, and examine the current disciplines from the perspective of other disciplines to expand the breadth of their own thinking with depth. The major of building electricity and intelligence itself is a particularly comprehensive discipline, and the solution of building electrical and intellectual problems often relies on the knowledge of other disciplines.

3.3. Cooperative Learning

Group cooperative learning is the most important form of learning in the PBL teaching model, which runs through the entire teaching. The problems in PBL are complex and ill-structured, which is difficult for students. They cannot easily and smoothly complete all their tasks by their individual abilities, so they need to rely on the form of group cooperation. In PBL teaching, teachers divide students into groups according to certain principles. Each group member has their own strengths and complements each other's advantages, so as to divide labor reasonably and cooperate efficiently. When faced with a problem, the members of the group first make a clear division of labor, determine the tasks that each member needs to undertake, and then explore the problem. Since each student's life experience, knowledge background, perspective on problems, and methods of finding information are not the same, the exchange and discussion of members in the group is conducive to the enlightenment of thinking and the collision of inspiration. Communication between different groups is conducive to learning from each other and optimizing the program.

3.4. The Clue of Problem

In the PBL teaching mode, questions are the main line of PBL teaching, and questions lead the entire learning process. Problems are complex and ill-structured, but not disorganized and clueless. The questions in PBL are related to the knowledge learned and pave the way for the teaching content. There may also be connections and correlations between questions. The previous question is the foundation of the next question, which is interlinked and gradually advanced. Students can study and think in a certain logical order.

3.5. The Exploratory Nature of Process

The process of problem solving is a process of learning and inquiry. In the face of poorly structured, complex and difficult problems, students cannot solve them all at once. They need to constantly collect various materials, constantly analyze the information in the problem, constantly study the nature of the problem, and constantly try their ideas and methods until the problem is solved. In the process of solving such problems, students are like explorers and discoverers, constantly trying and exploring the best solution.

4. Theoretical Analysis of PBL Teaching Mode in the Teaching of Building Electrical and Intelligent Disciplines

The PBL teaching model emphasizes problem-centered, student-centered, and requires students to focus on the actual problem situation of building electrical and intelligent professional courses, closely combine the guidance of teachers, and discovers, analyzes and discusses problems related to building electrical and intelligent subject through independent inquiry and group cooperation. Students are also required to master the knowledge and skills of this subject, so as to improve the ability to discover, analyze and solve problems. Whether the PBL teaching mode is suitable for the teaching of building electrical and intelligent subjects requires a theoretical analysis. This paper mainly analyzes the characteristics of the teaching of building electrical and intelligent professional courses and the teaching function of the PBL teaching model.

4.1. The Characteristics of Building Electrical and Intelligent Disciplines

The major of building electrical and intelligence integrates "building", "communication", "control", "electrical" and other related fields. Since it is a new major, each college has its own emphasis on the basis of its original major. The training of building electrical and intelligent professionals, especially the training of applied talents, should also closely follow the needs of social development. This research will first analyze the PBL teaching method of the characteristics of building electrical and intelligent professional disciplines, firstly taking the three courses: "Building Electrical and Intelligent Engineering Project Management", "Construction Equipment Engineering Drawing and CAD" and "Microcomputer Principle and Its Interface Technology" as pilot projects and standardizing the process of PBL teaching method, evaluating the effect and summarizing lessons learned, and promoting the application to other courses.

4.2. The Function of PBL Teaching Mode in the Teaching of Building Electrical and Intelligent Disciplines

The PBL teaching model takes problems as the driving force for learning, and teachers carefully set problem situations so that students can ask questions on their own initiative. Under the guidance of teachers and with the help of classmates, students cooperate with each other to solve problems together. Throughout the problem-solving process, students can give full play to their creativity, make their own suggestions, plans, and demonstrate solutions to problems. The problem-centered PBL teaching model provides a platform for students to develop their creativity, stimulates students' problem awareness, encourages them to ask questions boldly, and improves their ability to solve issues related to building electrical and intelligent subjects in analyzing and solving problem process.

To have the ability to innovate, one must first have innovative thinking, and the problem is the starting point of innovative thinking. Einstein emphasized that "discovering and elaborating a problem may be more important than getting an answer. The answer may simply be a question of mathematical or experimental skills, and asking new questions, new possibilities, and thinking about problems from new perspectives requires creative imagination, and marks the real progress of science." All innovation begins with the discovery of problems, and discovery of problems comes from a strong sense of problem. Strong problem consciousness, as the driving force of thinking, urges people to discover and solve problems, until they make new discoveries and innovations. The PBL teaching model takes the problem as the core and carries out teaching around the problem chain, which is conducive to stimulating students' problem awareness, cultivating their thinking of seeking differences, and ultimately improving their innovation ability in building electrical and intelligent subjects.

A shortcoming of existing education is that there is a large gap between what is learned in the classroom and the knowledge and abilities that students are likely to use when they enter society. The problems created under PBL teaching are closely related to current study and life or future work and life. At the same time, teachers provide students with many meaningful and applicable relevant classroom materials, providing students with a virtual platform, or even a practical platform for them to use what they have learned. When students see the connection between their study material and their own real life, their enthusiasm is quickly mobilized. They will do their best to learn and master relevant information, and use the knowledge they have learned to solve problems, thereby improving their practical ability, narrowing the distance between knowledge and application, and making up for the lack of high scores and low skills in traditional education.

5. The Experimental Application of PBL Teaching Mode in the Teaching of Building Electrical and Intelligent Disciplines

5.1. To Set Up Study Group

The research object of PBL teaching in the classroom of building electrical and intelligent subject is the problem of poor structure. Although it comes from daily life, this kind of problem is not a problem of good structure, and there may not be a very suitable solution. A mature plan cannot be obtained by single person, therefore, in the PBL classroom learning, it is necessary to establish a stable study group for a long time to form an orderly discussion atmosphere. Within the study group, members must first have independent thinking, and then each person must have a corresponding division of labor and tasks during the discussion.

5.2. To Create Problem Situations

Problem situation is the core of the PBL teaching mode of building electrical and intelligent Disciplines, and it is the beginning and starting point of course learning. The problem situation must be able to trigger cognitive conflicts in students who are eager to solve the problem but cannot solve the problem on their own. The problem situation comes from the reality of life in the real world and serves the entire teaching of the building electrical and intelligent disciplines. The problem situation may also be a problem trap deliberately set by the teacher. Problem situations can be presented in a variety of ways, including audio and video, text and images, experiments or field practice. Therefore, teachers should keenly capture ill-structured problems that can cause students to have strong cognitive conflicts from all the materials, and process and deal with the problems so that the problems can revolve around the teaching content and serve for teaching process.

5.3. To Break Down the Problem Chain

The learning of building electrical and intelligent disciplines under the PBL teaching mode always revolves around the building problem chain, which is composed of sub-problems. The sub-problems are usually small in scope and moderate in difficulty, which provides favorable conditions for students to solve problems. Students solve the sub-problems of building electrical and intelligent disciplines step by step, and finally complete the problem chain. Therefore, when preparing lessons, teachers need to clarify the curriculum standards and design the professional curriculum problem chain according to the students' learning situation. The main problem is mainly based on the situation and the sub-problem needs to be combined with knowledge points to deepen and decompose the main problem and to build a strong base for students' professional course study.

5.4. To Explore Group work

Due to the inferior structure and complexity of the problem, a solution often cannot achieve ideal results, and students cannot solve the problem at once. In the process of problem solving, members in each group need to think many times. In the collision, everyone brainstorms, constantly discusses and tries to adjust their thinking and improve the solution to the problem, until they came up with the most appropriate solution to the problem, and finally got the answer to the professional class question. In the process of group study and cooperative exploration, teachers need to understand and grasp the dynamics and situation of students in a timely manner, and conduct targeted broadcast and guidance to students' difficulties to ensure the effectiveness of group cooperative learning. Teachers need learn to guide in a persuasive manner, so that students' discussions and solutions revolve around the subject of the discussion, avoiding deviations from the subject. When each study group has come up with the best solution, teachers can organize each group to send representatives to display and

communicate the results, so that the results of learning can be shared with each other and promote common progress.

5.5. To Evaluate and Reflect Teaching process

Evaluation and reflection are essential and important links in the teaching process. In terms of evaluation methods, a diversified and multi-subject evaluation method is adopted. The evaluation forms include: student self-evaluation, student-student mutual evaluation, and teacher evaluation. In the process of summarizing and reflecting on problem solving, students can find out the rationality and reliability of the results of their own group, as well as their imperfections and areas that need to be improved by comparing their own group with other groups, and obtain problem solving methods. Students learn from the strengths of other people's projects in order to continuously improve the group's results. The teacher evaluates the performance of the students, and summarizes and emphasizes the teaching content of the subject of building electrical and intelligent in this class after the group presentation and communication, so as to help the students better grasp the key points of this class and the main points of the building electrical and intelligent disciplines, and finally complete the building electrical and intelligent classroom teaching tasks of this course. The implementation steps of the PBL teaching mode are shown in Figure 2.

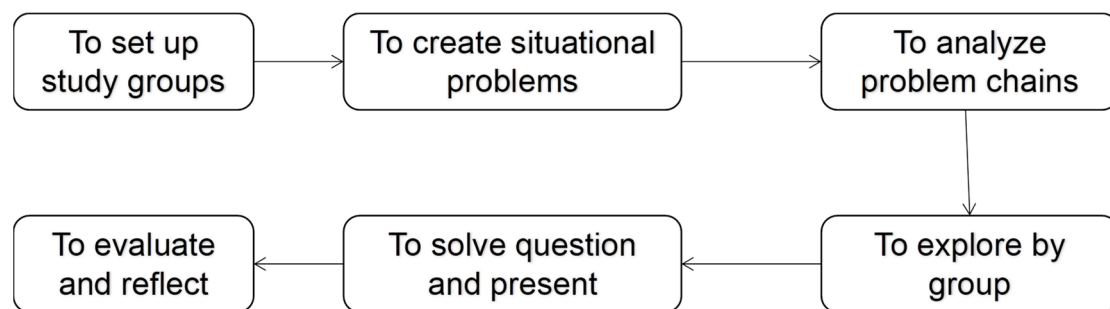


Figure 2. Implementation steps of the PBL teaching model

6. Conclusion

The cultivation of applied talents in building electrical and intelligent disciplines requires in-depth and solid practice. The application of PBL teaching can better improve students' autonomous learning ability and comprehensive practice ability. According to the characteristics of schools, students and disciplines, the PBL teaching model is based on complex problems in real life, creating certain scenarios to guide students to self-discover and analyze of problems. And through the formation of a learning community, students are allowed to gradually master the subject knowledge hidden behind complex problems in a relatively harmonious cooperative environment. Such a learning method is conducive to cultivating students' problem-solving ability, and cultivating students' "problem-solving ability" is one of the goals of the curriculum reform. This paper is dedicated to enriching the existing teaching methods and more effectively supporting the idea of curriculum innovation. The application of the PBL teaching model to the teaching of building electrical and intelligent disciplines not only enriches the intelligent teaching method of building electrical, but also provides teachers with a reference for teaching theories and teaching methods to build an open classroom. It also makes up the vacancies in the teaching of building electrical and intelligent disciplines and provides a practical reference for the teaching and research of building electrical and intelligent disciplines.

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