

# Exploration of Personnel Training of International Mechanical-Electronic Specialty under the Pbl Teaching Methods

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**ABSTRACT.** In order to improve the level of Sino-foreign mixed international education in our school, this paper takes the measurement and control technology and instrument international experimental class as the main body, and the PBL-based teaching method is used to explore the course of Measurement and Control Technology and Artificial Intelligence. From the perspective of teaching effects, the PBL-based teaching method is student-centred, takes curriculum issues as a platform, and forms a mixed group of Sino-foreign students, which can cultivate students' knowledge integration, problem analysis, language expression, document retrieval, and engineering society, personal team and communication skills, and at the same time, it can build a bridge of communication between Sino-foreign students. This exploration provides an operable prototype for the training of international Mechanical-Electronic talents in our department, and also provides a good beginning for the exploration of the teaching mode of international Mechanical-Electronic talents in our department.

**KEYWORDS:** Pbl-based teaching, Personnel training, Curriculum project, Internationalization

## 1. Introduction

With the increasing international cooperation and exchanges in education and the influence of the belt and road initiative, more and more international students come to study in Chinese universities. Faced with such a large group of international students, how to ensure the quality of education? How to improve teaching effect? How to make foreign students adapt to the differences, frictions and collisions brought by different cultures and regions <sup>[1]</sup>? For this reason, many universities in China have conducted research and educational reform on mixed international education between Sino-foreign countries <sup>[2-4]</sup>, such as letting foreign students study in the same class as Chinese students, promoting exchanges and interactions between Chinese and foreign students through cooperative discussion teaching and learning, mobilizing the enthusiasm of Chinese and foreign students to learn, and broadening their international horizons <sup>[5-8]</sup>.

In recent years, our school has introduced a large number of overseas high-end talents through various channels. The proportion of teachers with international research background has increased year by year, and significant progress has been made in the internationalization of the teaching staff. However, in terms of teaching internationalization, our teaching for local students and foreign students is still on paper. Although we have the prototype of PBL in the teaching process, for example, in the classroom, we designed a few simple questions for students to think and solve, and these questions are the important knowledge points to be taught, so that students can concentrate on the knowledge points to be taught. However, the role of the teacher is mainly to teach in the classroom. In response to these issues, this paper explores how to introduce PBL-based teaching method into the course of Measurement and Control Technology and Artificial Intelligence, taking the bilingual international experimental class of Measurement and Control Technology and Instrument as the main body, through the experience gained by domestic counterparts in the PBL-based teaching model, combining with the characteristics of the mechanical and electrical major in our department, and taking the problems to be solved in the industry as the driving force, and taking the training goal of engineering education certification in China as the quality control system of the course <sup>[9]</sup>, exploring the new model of international Mechanical-Electronic talent in our department.

## 2. The Implementation of Pbl-Based Teaching Method

Since our department is bidding for international experimental class of Measurement and Control Technology and

Instrumentation, it leads to the need for mixed teaching in this experimental class, and teachers need to comprehensively consider the characteristics of Sino-foreign students to formulate corresponding teaching strategies.

### 2.1 Implementation Method

In view of the differences Sino-foreign students, we are to explore a teaching method of application of knowledge and self-learning. Therefore, we divide students into several groups and try to have one foreign student in each group during the grouping process. Each group can be carried out according to the teacher's project, or according to the group members' self-designed subject project after consultation. The relevant factors of students' national background must be taken into account in the project, and the members whining the group freely select the group leader and arrange related tasks. In the implementation process of PBL-based teaching method, students are the main body of the project, and they need to play their subjective enthusiasm, and report the state of project to teacher and seek help in time according to the progress of the project and the problems encountered. In the whole PBL-based teaching process, the self-learning method<sup>[10]</sup> with students as the main body will be interspersed and connected. The details are shown in Figure 1:

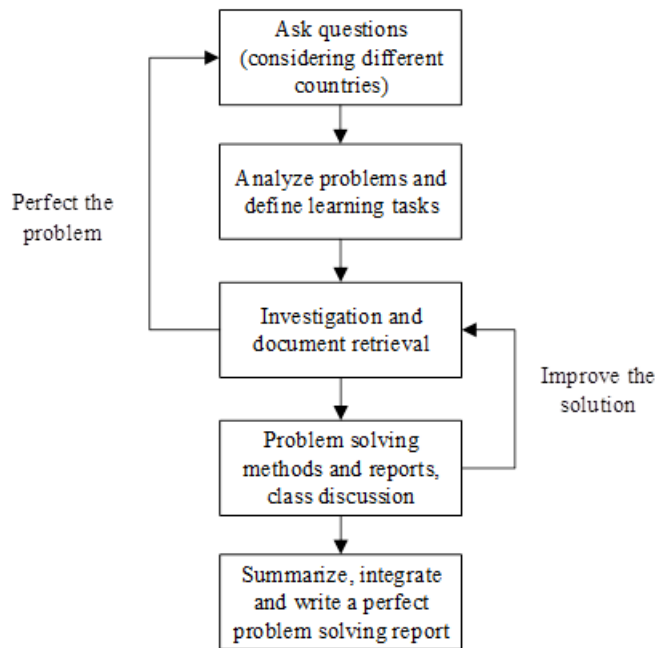


Fig.1 Implementation of Pbl-Based Teaching Method.

### 2.2 The Guidance for Measurement and Control Technology and Artificial Intelligence

In response to the severe epidemic of the COVID-19 this year, all the students are teaching at home in the form of online courses. Therefore, in the process of investigating their own projects, students should try their best to find problems according to their own national conditions, ask questions, search for documents and materials to solve these problems, and then discuss them with the students in class, and use the knowledge of this course to explore whether it is reasonable to understand these problems. Is the solution to the problem appropriate? At the same time, combining the customs and treatment methods of different countries, we can find one or several problem-solving methods suitable for different countries, so that students can learn in exploring practical problems and deepen their understanding of this course knowledge. Therefore, in order to make students better understand the problem-oriented approach, based on the teaching accumulation of Measurement and Control Technology and Artificial Intelligence course for many years, and the investigation and understanding of related companies, the following curriculum items are set as a guide to motivate students to develop their own group projects according to the wisdom of the group, shown in Table 1:

Table 1 Curriculum Problem Guidance

No.	Subject project	Involving knowledge points
1	Understanding of Measurement and Control Technology and Artificial Intelligence.	Measurement and control technology and artificial intelligence technology development

2	The latest positioning technology at home and abroad, including positioning in some complex environments.	Positioning technology in measurement and control
3	How to automatically open or close fire doors in underground spaces at home and abroad through robots?	Automatic control technology in measurement and control
4	How to intelligently detect and automatically deal with the drainage blockage of expressways at home and abroad?	Intelligent detection and deep learning
5	How to monitor abnormal events on domestic and foreign highways ?(such as retrograde/non-motorized vehicles on motorized lanes)	Deep learning
6	How to automatically navigate domestic and foreign robots in narrow spaces?	Navigation technology in measurement and control
7	How to automatically detect the inner wall of domestic and foreign sewage pipes or drainage pipes?	Automatic detection and deep learning
8	Self-designed	Determined by topic

### 2.3 The Guide Sino-Foreign Students to Solve Problems and Summarize Problems

After the students have completed the project, they will show the project in a group speech in the classroom. During the group speech, the students can evaluate and summarize the project by means of self-evaluation, mutual evaluation and other evaluation methods for the scheme and problem-solving methods in the group speech. First of all, each topic project team will give a general introduction to the topic project, mainly from the aspects of scheme design, what problems are encountered, how to solve the problems, what problems are not solved at present, and what is the difference between domestic and foreign solutions to this problem. Then, each project team will show it through PPT presentations, and other teams will evaluate them according to the group's presentations or their own professional knowledge, and put forward their own questions or propose their own solutions to the project, and discuss the advantages and disadvantages of the course project. The teacher controls the process and instructs the students to use the knowledge of the course to analyze and solve the problems, and promptly summarize and comment on the advantages and disadvantages of each group in the project. If the students of a certain project team are perfunctory and do not do a good job in the research of the project, they are required to make improvements and give them a second chance to speak. In this process, the teacher will guide the project team to complete the project, so that they learn to summarize and consciously reflect on the process of the entire solution method of the project, and they can develop a good habit of solving questions, analyzing and summarizing problems in the future course study. The whole process of guiding Sino-foreign students to solve problems and summarize problems through speeches and discussions is shown in Table 2:

Table 2 Process Table For Guiding Sino-Foreign Students to Solve Problems and Summarize Problems.

	Student process	Teacher process
Group communication	Each group forms its own group based on the course questions or the questions of interest	Whether it is appropriate for teachers to supervise and guide each group course
Division and cooperation	Each team member divides the work and discusses the solution to the course problem	The teacher guides the problems arising from division of collaboration
Speech and discussion	Each group make a PPT according to the solution of the course problem and give a class speech, and other students ask questions	The teacher controls the progress of each group presentation and discussion time
Summarize the problem	Each group summarizes the deficiencies in the solution to the problems of the course based on the speech and discussion	The teacher guides the summary questions of each group
Achievement evaluation	Each group conducts self-evaluation on the summarized issues and evaluates each other	The teacher evaluates each group based on the results of the group evaluation

### 3. Conclusion

From the perspective of classroom teaching, student speeches, discussions, course summary tables, and student

paper reports, the following effects have mainly appeared:

(1) In the course Measurement and Control Technology and Artificial Intelligence, more than 70% of students have a basic understanding of measurement and control technology and artificial intelligence technology, which is easier to understand than the previous teaching method, which improves their learning efficiency and the cultivation of their thinking ability.

(2) In the traditional teaching method, teachers teach and students listen to the same teaching mode. This kind of teacher-centred teaching method has long been familiar and tired of this teaching mode. In the PBL-based teaching method, the course project is the foundation, and the students are the main body of the course, and the students should solve the problem independently according to the course problem. In the course Measurement and Control Technology and Artificial Intelligence, more than 75% of the students believe that the PBL-based teaching method has realized a close connection between the teaching content and practical problems, which not only enables students to associate the teaching content of the course according to practical problems, but also improve their ability to solve practical problems. At the same time, it also improves the communication and teamwork spirit between Sino-foreign students, and stimulated their initiative to learn new knowledge.

(3) Through the mixed grouping of Sino-foreign students, 80% of students' language expression ability has been improved, which has a lot to do with their need to communicate with each other in the process of solving problem. At the same time, the friendship between Chinese and foreign students has also improved. Unlike the previous class, there is little communication between them.

(4) According to the reports submitted by the students, more than 75% of the students can solve problems, summarize and analyze and evaluate problems by themselves through the Internet, the library, and the insights in daily life, which not only deepens their understanding of the theoretical knowledge, but also can solve practical problems with the knowledge they have learned, which plays a subtle role in solving the problems they encounter in the future.

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