

# Application of CDIO in PLC Teaching

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**Abstract.** Analysis of the current situation of PLC teaching, according to the problems of PLC teaching, the teaching mode based on CDIO PLC is put forward. The CDIO mode is based on actual project as the carrier, it changes the old teaching mode, old teaching mode is from theory to practice, now it is from practice to theory, it can improve the learning enthusiasm and initiative of students, and train the students' ability of practice and innovation. It provide a new idea for teaching reform in related disciplines.

**Keywords:** CDIO; Teaching; PLC.

## 1. Introduction

PLC course is an important professional course of mechanical and electrical engineering, through the study of PLC curriculum, students gain the ability of independent use of PLC design and development of actual industrial control process, at the present stage, most colleges and universities have focused on the theory of explaining the PLC teaching, it lacks cultivation of practical ability [1]. But the PLC course is a very practical course, when learning theory, at the same time, more attention should be paid to the cultivation of practice ability. CDIO teaching model is the engineering education mode reform co- founded by American Massachusetts Institute of Technology, the Swedish Royal Institute of industry university and Linkoping University in Sweden, Charles Moss [2-3], CDIO is Design, Implement on behalf of Conceive and Operate, it is the latest achievement of foreign engineering education reform, it makes use of the whole life cycle of the products, so that students can make engineering study in an active way, foreign practice has proved that CDIO is more flexible than the traditional teaching methods, and can improve teaching quality [4]. In order to change the present situation of PLC theory of derailment of teaching and practice, this paper introduced CDIO into PLC teaching to cultivate students' creative thinking, the ability to analyze problem and solve the problems. It can comprehensively improve the level and quality of PLC teaching, and cultivate more qualified talents for the society and enterprises.

## 2. The shortcomings of the traditional PLC Teaching

### 2.1 The disconnection between theory and practice

In PLC teaching process, teachers are generally carried out in accordance with the contents of textbooks. Students can only learn the basic knowledge, but cannot understand the importance of PLC [5]. In the study, they do not understand the actual application of PLC, and do not know the important role of PLC in the field of industrial control. Because they do not know the important role of PLC, they are unable to understand the the important position of PLC occupied in the future work. Only the most basic knowledge of PLC is described on general textbook, its application in industry in depth is not described, there may be some simple experiments, the students even do experiments also in accordance with the instructions of the steps, there is no creativity. With the continuous adjustment of industrial structure, the technical personnel of the engineering requirements is becoming higher and higher, the disadvantages of the traditional teaching mode is constantly exposed, students are only passive acceptance of knowledge in the course of teaching, they cannot get the ability of Engineering practice training.

### 2.2 Single assessment methods

Assessment method of PLC teaching is single, theory examination and practice examination are separated. This assessment focused only on the final evaluation results, it is not conducive to the cultivation of talents. Students only focus on knowledge of the curriculum were reviewed before the examination, and the focus of knowledge are required in the syllabus, this learning process causes the knowledge and the ability dose not match, it cannot really reflect the situation of teaching. At the same time, in this mode, the students can meet the test only by a simple review, it does not take the initiative to explore the passion, and cannot experience the fun of learning, it will not go to innovation, students cannot get true ability.

**2.3 The lack of cultivation of team competence**

Comprehensive training team project has little in the traditional PLC teaching, under this model, students' individual consciousness is strong, and it lacks the cultivation of team spirit and cooperation ability. But now the society demands more and more on talented persons, among them, two important indicators are team spirit and cooperation ability. Interpersonal skill training is an important part of engineering practice training in teaching. Students do not get effective training, resulting in lack of understanding of engineering practice, a departure from the actual needs of enterprises and the society.

**3. Application of CDIO**

**3.1 PLC teaching idea under the mode of CDIO**

CDIO is stand for Conceive, Design, Implement and Operate. The teaching idea of PLC is shown in Figure 1, on the basis of engineering practice, the corresponding adjustment and integration is done to the key content of courses, improving the practicality of the course. The teaching content is close to the relevant state departments` skills assessment requirement, improving the adaptability of society and industry. The degree of difficulty of teaching is determined, so that students can accept PLC curriculum knowledge better.

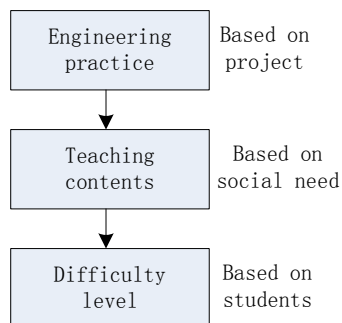


Figure1. The teaching idea

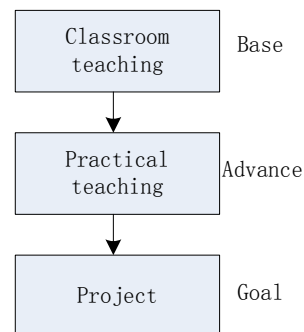


Figure2. The process of teaching

In the process of teaching, strengthen the practice link. As shown in Figure 2, the traditional teaching is divided into three aspects of classroom teaching, practice teaching and the actual project, these three aspects are from the shallower to the deeper, complement to each other, it can make students understand the PLC course better, stimulate the curiosity of students, and enhance practical ability.

**3.2 PLC teaching method under the mode of CDIO**

In CDIO mode, the teaching method is "combining learning with working". It uses products for the carrier, and it is project oriented. This method breaks the traditional mode, it is turned from practice to theory. Students can enhance the perceptual knowledge of PLC, make clear their learning objective and learning focus. As shown in Figure 3, it is the comprehensive utilization of resources inside and outside school, through a combination of laboratory and school enterprise combination, the project driven is achieved, which improves the practice ability of students. As shown in Table 1, in the actual teaching, each project is decomposed, the project teaching is with the new knowledge, and the students can personally do the development and application of PLC control system.

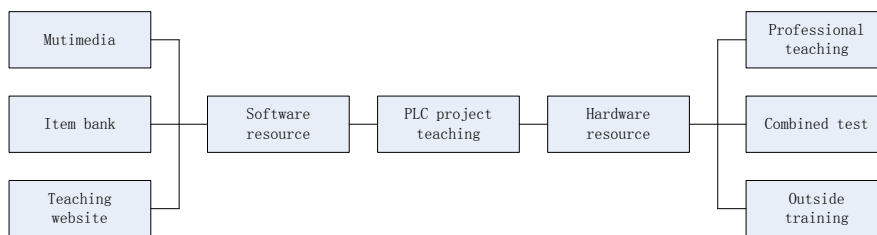


Figure3. The resources  
Table1. The teaching project

Project	Subproject	Teaching method
Basic instruction	Light control	Case method
	Motor control	Case method
Application example	Garage control	Case method
	Washing machine control	Case method
Design and transformation	Traffic light control	Task-driven method
	Machine tool electric transformation	Task-driven method

### 3.3 PLC teaching assessment under the mode of CDIO

The final examination is different from the traditional way, under the mode of CDIO, PLC assessment not only need to examine the students' understanding of knowledge points, pay more attention to the students to master the ability of engineering practice. The assessment is divided into two parts, the first part is the study of comprehensive practical ability, for a total score of 50%, including the completion of comprehensive practical ability in classroom performance and project; the second part is the investigation of textbook knowledge points, for a total score of 50%, based on the outline of knowledge points to increase the program design subject, targeted on the study on the knowledge.

### 4. Conclusion

In CDIO mode, the PLC teaching is with the actual project as the carrier, it changes the old teaching mode, and it cultivates professional knowledge and comprehensive quality in the teaching process of PLC. The method from theory to practice changes into from practice to theory, it improves the enthusiasm and initiative of students, and strengthens the cultivation of students' comprehensive quality, knowledge and social development connects closely, the train of students can meet the social and business requirements, and it laid a good foundation for future employment.

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