

# Research on Project-Based Teaching of Railway Signal Basic Equipment Maintenance

Yangbo Tang

Guangzhou Railway Polytechnic, Guangzhou 510430, China.

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**Abstract:** The daily maintenance of railway signal basic equipment by railway electrical service department mainly refers to the daily maintenance, troubleshooting and timely treatment of annunciator, track circuit, signal relay, turnout and switch device, which is also one of the professional skills that signal workers need to master. The project-based teaching method is adopted for students. Through the integrated teaching mode of teaching, learning and doing, students can transform their theoretical knowledge into practical ability through projects, change the traditional single assessment method, and combine the final examination with the process assessment of practical operation and theoretical learning, which can better help students master and improve their professional skills.

**Keywords:** Railway Signal Infrastructure Maintenance; Project-Based Teaching; Assessment Method

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## 1. Introduction

Railway Signal Basic Equipment Maintenance is a professional core course for cultivating high skilled talents in signal equipment maintenance and management for the front line of railway transportation production. Signalman is a type of work with high technical requirements in the railway transportation department, which needs to have certain theoretical knowledge and practical ability, and can carry out daily maintenance and overhaul of railway signal basic equipment according to enterprise standards. Therefore, the course needs to systematically teach students the relevant theoretical knowledge of signal basic equipment, cultivate students' practical ability and gradually improve their own comprehensive skills through course project-based training.

## 2. Overview of project-based teaching

Different from the traditional teaching methods, project-based teaching breaks the traditional teacher-centered teaching method and the traditional student visiting practical teaching. Project-based teaching gives students more opportunities for practice, so that students can better understand and master the theoretical knowledge through practice. The traditional teaching method does not combine theory with practice, which leads to the fact that once students enter the job. They still need to slowly rely on theoretical knowledge to explore the practical skills of signal workers, which is a great test of students' knowledge transfer ability. Project-based teaching is a behavior oriented teaching method, which combines the theoretical knowledge with the actual work content, divides the theoretical knowledge in the course into several different projects according to the actual work content, and sets corresponding learning tasks for each project. The whole teaching process takes the project as the medium and uses the learning task to drive the project, so that students can master the ability of hands-on practice in the project by completing the learning task to improve the level of students' professional skills.

## 3. The change of course content in the context of project-based teaching

### 3.1 Change of course nature

This course is set up according to the basic ability of signal workers inside and outside the building of railway electrical service department. It is the most basic core course of railway signal automatic control specialty. The course teaching focuses on cultivating students' professional skills. Through the selected enterprise cases or projects, students can master the

standardized operation process of railway signal workers through integrated teaching and practice, have the ability of maintenance and repair of railway basic equipment, and make students' professional skills more in line with the post requirements of railway signal workers.

### **3.2 Change of course objectives**

The teaching goal of this course is to enable students to master the structural characteristics and working principle of various relays through learning and practice; They should be familiar with the structure of the signal, and master the electrical parameter test method of the signal, so as to be able to independently complete the daily maintenance and repair of the signal and handle the simple fault of the signal; They also clear the basic composition and function of track circuit, be able to cross check the polarity of 25Hz phase sensitive track circuit, and check the simple faults of 25Hz phase sensitive track circuit; For common switch switching equipment, such as ZYJ7, S700K, ZDJ9 and other switch machines, they should be very clear the structural composition and action principle, so that the mechanical parameter test and electrical parameter test can be carried out correctly according to the action principle, and the common faults of switches can be analyzed and handled according to the measured parameter values.

The course objectives pay more attention to improving students' skills and the ability to analyze and solve specific problems.

### **3.3 Change of course content**

We can select appropriate projects or enterprise cases according to the course objectives, and integrate the course content into the selected projects. The course mainly involves four basic equipment of railway signal, namely signal relay, annunciator, track circuit and turnout switch equipment, so that students can understand and master the composition, working principle and maintenance methods of different equipment.

Through project-based teaching, this course aims to make students familiar with the equipment structure, master the equipment maintenance process, test the electrical parameters of the equipment, and learn to analyze and troubleshoot the equipment faults. In combination with the professional skill appraisal standards of the specialty and the requirements of the actual job on this course, the course content of Railway Signal Basic Equipment Maintenance is sequenced and integrated. The integrated course content carries out practical training for students from four aspects: signal relay, track circuit, annunciator, turnout and switch equipment. Among them, the signal relay part is set with three learning tasks, the track circuit part is set with four learning tasks, the annunciator part is set with four learning tasks, and the turnout and switch equipment part is set with five learning tasks. Students are guided by learning tasks and improve their practical ability through project-based teaching.

## **4. Specific implementation strategies of project-based teaching method**

### **4.1 Organizational framework of project-based teaching**

The course mainly uses project-based teaching. The teaching method is carried out around students. The main body of teaching is students, in which teachers only play a guiding role. Students need to complete the relevant learning tasks set in each project, and complete the learning tasks in the project through the following six steps. The six steps are: Step 1: obtain the data needed to complete the task; Step 2: plan the task; The third step is to select the best task scheme; Step 4: implement according to the selected task plan; Step 5: after completing the scheme, check the implementation process to ensure there is no omission; Step 6: complete the task and conduct assessment and evaluation. The whole project is driven by the learning task, which urges students to complete the project, so that students can master relevant theoretical knowledge and improve their ability of hands-on practice by completing the learning task.

### **4.2 Specific steps of project-based teaching**

The use of project-based teaching method is to combine theory with practice, so that students can better master the

vocational skills required by the course through the integrated teaching mode of "teaching, learning and doing". The whole learning content of the course involves integrated classroom, indoor training room and outdoor station training field.

Through the analysis of students' learning situation, the class is divided into several groups.

Before class, the teacher arranges the learning tasks to be completed in the project for the students, and the students watch the micro class video before the general class. In class, teachers transfer knowledge to students through enterprise cases. In this process, teachers guide students to ask questions and think. Teachers guide them pertinently to solve the key and difficult points of corresponding knowledge points. Then let the students practice in the indoor training room and outdoor station according to the designed scheme, and verify the designed implementation scheme through hands-on practice. In the process of practice, the teachers of all groups patrol and put forward their own opinions and improvement measures according to the students' mastery. Demonstration and demonstration are also needed for key skill points to improve the students' practical effect. After each group completes the task, the task summary shall be carried out in groups, so that students can evaluate each other, and teachers can make summary evaluation. Teachers should give more positive evaluation to students and encourage students to participate in project-based teaching more attentively <sup>[1]</sup>.

Project based teaching aims to cultivate students' autonomous learning ability and their ability to find and solve problems, and integrate the process of students' learning theoretical knowledge into practical training, in order to better understand knowledge points and master skills points through practice, better master the vocational skills required by railway signal workers, and help students adapt to their posts and integrate into the working environment faster.

## **5. Integrating project assessment into assessment methods**

The traditional assessment method of curriculum theoretical knowledge usually takes the class as the unit. After students complete a project, they are subject to phased closed book examination, and the key knowledge involved in the project is assessed. Through the assessment, students' mastery is tested, and the assessment score is 100 points <sup>[2]</sup>.

In project-based teaching, we need to reform the process assessment method and completely change the traditional assessment method. The project-based course is mainly based on process evaluation and assessment. There are different learning tasks in each project. Teachers evaluate and score according to students' completion of learning tasks in the project, cooperation between teams, professional quality and so on. At the same time, after each group student completes the task, the group will conduct group self-evaluation and scoring, and the group members will also conduct mutual evaluation and scoring. Different evaluation subjects input the process scores into the learning link platform. The platform records the process scores of each student and each project, and draws the process assessment score details and the total process assessment score.

The process assessment is still a 100 point system, which assesses the students' usual learning situation, attitude, discipline and practical ability in an all-round way, so as to ensure the diversification of assessment contents and the diversification of evaluation subjects, achieve fair, real and effective result feedback. Teachers can timely adjust their teaching progress and teaching objectives according to the feedback results.

## **6. Conclusion**

Learning the course Railway Signal Basic Equipment Maintenance well can enable students to master the necessary skills such as maintenance and simple overhaul of basic signal equipment inside and outside the signal building, and play an important guiding role in the study of subsequent professional core courses and the cultivation of students' practical habits.

Project-based teaching can cultivate students into highly skilled talents who are more suitable for professional requirements and job requirements. According to the teaching objectives of the course, set a relatively perfect teaching mode and assessment mode, so that students can better master professional skills and professional theoretical knowledge in project-based teaching, become highly skilled talents needed by rail transit signal industry, and be able to achieve zero distance competent job after entering the job.

## References

- [1] Liu L. Application of microcomputer monitoring technology in railway signal equipment maintenance [J]. China new communications 2021;23(04):121-122.
- [2] Zhang Y. Research on project-based teaching of Railway Signal Basic Equipment Maintenance [J]. Scientific and technological economic market 2016;(09):132-134.