Teaching Reform of Urban Rail Transit Interlocking System Maintenance in Higher Vocational Education

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ABSTRACT
Curriculum is the basis for higher vocational colleges to carry out educational and teaching activities, and it is the fundamental guarantee for higher vocational colleges to achieve the goal of personnel training. Because the students' learning enthusiasm is not high, the curriculum goal is difficult to realize. Therefore, the curriculum teaching reform is imperative. The article focuses on problems, such as the inconsistency between the course content and the work content in the course teaching, the lack of advanced course idea, reasonable teaching design, high-quality course resources, effective course evaluation, and being difficult to teach "Computer Interlocking System Fault Treatment". We put forward a series of curriculum reform measures which have been taken to solve the problems. The application of the results of the curriculum reform in the curriculum teaching, the reform of teaching methods and learning methods, have greatly stimulated the students' interest in learning, fully mobilizing the enthusiasm of students, thus realizing the steady improvement of the quality of personnel training.

Keywords: *Talent Training Quality, Interlocking System Maintenance Course, Teaching Reform.*

1. INTRODUCTION

In 2015, the Ministry of Education issued the action plan for innovation and development of Higher Vocational Education (2015-2018) (hereinafter referred to as the action plan), that stresses the core of higher vocational colleges should enhance the employment and entrepreneurship ability of students, strengthen ideological and moral education, humanistic quality education and technical skills training, and improve the quality of personnel training in an all-round way. With the adjustment of China's economic structure and the establishment of market economy, the social demand for advanced technical talents is no longer limited to a single vocational ability, but includes all the qualities such as knowledge, skills, and attitude. Curriculum is the basis for higher vocational colleges [1] to carry out educational and teaching activities, and is the fundamental guarantee for higher vocational colleges to achieve the goal of personnel training. In order to meet the needs of higher vocational education and social development, it is urgent to speed up the reform of curriculum education [2] and teaching.

Take the course Maintenance of Urban Rail Transit as an example. Interlocking system is a core course for the major of Urban Rail Transit Communication Signal Technology. This course trains students [3] to have good professional qualities such as following rules and regulations, studying and practicing diligently, cooperating together, loving and respecting work, being able to operate the interlock equipment console correctly, knowing the circuit diagram and wiring diagram of the interlock equipment, carrying out the daily maintenance and centralized maintenance of the interlock equipment, handling the common faults of the interlock system [3]. Because the student's learning enthusiasm is not high. Therefore, the course training goal is very difficult to realize. After years of exploration and practice in the reform of curriculum and teaching, we have found a set of effective methods, which have effectively stimulated students' interest in learning and fully mobilized their enthusiasm for learning. Thus, the quality of personnel training has been steadily improved.

2. APPROACH

In the course teaching, we found the problems such as inconsistency between the course content and the work content, lacking the advanced course idea, the reasonable teaching design, the high quality course resources, the effective course evaluation and being

difficult to teach "Computer Interlocking System Fault Treatment". These problems have seriously affected students' learning enthusiasm and initiative. We have taken the following measures to effectively solve these problems.

2.1. Based on the Professional Position-Oriented Curriculum Development Method

Based on the professional position-oriented curriculum development method, the curriculum content is reconstructed, and the inconsistency between the curriculum content and the work content is solved [4].

2.1.1. Analyse the Main Tasks of the Post and Their Corresponding Core Competencies

The major of Communication and signal technology in urban rail transit is oriented to Metro Operation Unit, and its corresponding occupation is communication and signal engineering. This paper analyses the job tasks of communication workers and signal workers and their corresponding professional abilities, and according to the national professional skill standards of communication workers and signal workers, extracts the main job tasks of the posts and their corresponding core professional abilities.

2.1.2. Identify the Core Professional Courses

According to a certain logical relationship, the main work tasks are combined to get the typical work tasks, and the typical work tasks are transformed into the name of the core course. A total of seven core courses were identified in this way. They are: Maintenance of Urban Rail Transit Signal Infrastructure Equipment, Maintenance of Urban Transit Interlocking System, Maintenance of Urban Rail Transit Automatic Train Control system, Maintenance of Urban Rail Transit Power Supply System, Maintenance of Urban Rail Transit Special Communication System, Maintenance of Urban Rail Transit Communication Transmission System, and Maintenance of Urban Rail Transit Wireless Cluster System.

2.1.3. Establish a Professional Curriculum System

The core curriculum is the foundation of the curriculum system. Taking the core curriculum as the starting point, considering the overall requirements of higher vocational education for students' political, physical, mental, humanistic and scientific qualities, and considering the development of students' career migration ability and entrepreneurial innovation ability, taking into account the improvement of students' comprehensive vocational ability and the development of regional economy, the rational allocation of public basic courses, professional basic courses, professional development courses and practical courses, and following the law of people's professional growth and the law of learning cognition, the curriculum is designed in order to form a professional curriculum system.

2.1.4. Set Curriculum Standards

The main task of the reference signal post is to locate the course objective. Taking "equipment" as the carrier and following the law of teaching, five teaching items were determined, and the course contents of the core vocational ability of signal work posts were organized according to the "teaching items". Based on the real work task and its working process, the curriculum standard of this course is formed by integrating and ordering the curriculum contents.

2.2. In Line with the "Co-Construction and Sharing" Principle, Strengthen Multi-party Cooperation and Constantly Improve Curriculum Resources

2.2.1. The School-enterprise Union and School-school Union Publish the Project Task-based Teaching Materials

Our school, together with Wuhan Metro Group Co. Ltd., Xi'an Vocational and Technical College of railway transportation, and Nanjing Vocational and Technical College of Railway, has jointly prepared the task-based teaching material for the maintenance of urban rail transit interlocking system, it was published by the Publishing House of Electronics Industry in August 2017.

2.2.2. Build a MOOC Course for Intelligent Vocational Education

Teachers, students, enterprise experts, micro lesson production companies and other cooperation, have built up the digital resource that matches with the teaching material, including micro-lesson, animation, PPT, in-kind pictures, test database, and expand resources. The online course, which began in late 2018, has been used in the cloud classroom teaching of intelligent vocational education. The course has been launched simultaneously on the MOOC platform of intelligent vocational education and has completed three teaching semesters.

2.2.3. Build a Multi-functional Training Base

6502 Electric centralized equipment maintenance training room, and TYJL-II computer interlocking system maintenance training room provide better places for the course practice teaching. However, compared with the on-site equipment, we have fallen behind. In 2019, in cooperation with Jie'an hi-tech Co., Ltd., and

engaged experts from Wuhan Metro Group Co., Ltd. our school participated in the demonstration of the construction plan of the training room [5], and built the maintenance training room of the Rail Transit Computer interlocking system (DS6-K5B type), which realized the curriculum teaching, the skill appraisal, the external training, the teaching research and so on many functions.

2.3. Focus on Learners and Optimize Instructional Design

Compiling excellent ideological and political cases [6], implementing the content of "three-minute ideological and political course" into the teaching plan [7], breaking the old concept of "teaching as the centre" from four aspects of teaching analysis, teaching strategy, teaching implementation and teaching reflection, carefully design each teaching unit teaching plan, we carry out the course teaching in an orderly way to realize the teaching goal.

2.4. Implement Process Assessment and Improve Course Evaluation

The course assessment includes five items: online learning intelligent vocational MOOC course, interlocking diagram reading, key circuit reading, computer interlocking system technology and working principle defences, 6502 electric concentration and computer interlocking system maintenance experiment training; According to the different assessment content, the evaluation subject can choose among self-evaluation, mutual evaluation and teacher evaluation. Through the process of assessment, from the knowledge, skills, attitude of three aspects of comprehensive evaluation of students, it is oriented to promote the comprehensive vocational ability of students.

2.5. The Computer Interlocking System Fault Treatment Method-"Four Three Four"

The fault treatment of computer interlocking system is a very comprehensive and difficult teaching content in the course of maintenance of urban rail transit interlocking system. Through years of teaching and research, the "four-three-four" method, which is used to deal with the faults of computer interlocking system, is explored and practiced.

In “Four-Three” means that four information channels and three circuits explain the computer interlocking system principle of work. The four information channels are input channel of collecting information, output channel of control command, input channel of operation command and output channel of representing information. The three kinds of circuits are the switch control circuit, the signal lighting circuit and the track circuit. TYJL-II computer interlocking system is taken as an example, and its system structure is shown in figure 1.

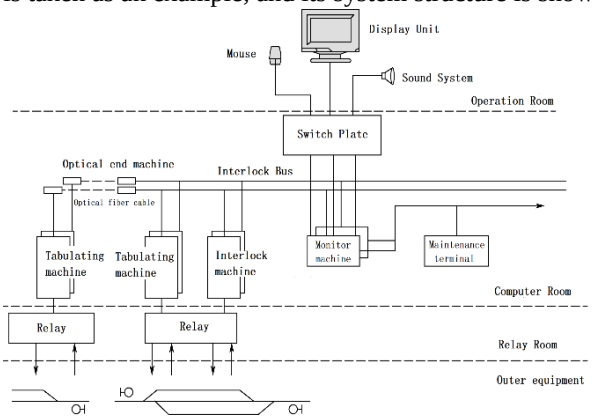

Figure 1 Structure of TYJL-II computer interlocking system.

When the station attendant uses the mouse to handle the traffic operation, the mouse information enters the interlock machine CPU board through the Operation Command Input Channel. At the same time, the CPU board of the interlocking machine collects the status information of the field signal equipment (turnout, signal machine, track circuit) through the information input channel to carry on the interlocking logic operation, output control commands of the action switch and the open signal through the control command output channel. The control commands act corresponding relay. The relays connect the switch control circuit and Signal Light Circuit, the final signal open. Finally, the interlock CPU board outputs the video and voice information to the console through the information output channel for the station attendant to understand the operation.

“Four” is the four-step method of fault handling. The first step is through the console phenomenon to determine that one or more of the four information channels have a fault, to narrow the fault range. The second step, by observing the status of the relay signal equipment room (dynamic observation). The third step, if it is the fault of the Information Channel, the fault range can be further narrowed by the state of the indicator light of the computer interlocking cabinet. In the fourth step, if it is a circuit fault, the first step is to distinguish the indoor fault from the outdoor fault through the instrument test on the distributor, and then to find the fault.

3. RESULTS

We apply the results of the above course teaching reform [8] to the course of maintenance of urban rail transit interlocking system. Before and after class, students learn courseware, complete questions, discussions, homework, tests and exams, and acquire

the ability of self-study [9] while mastering the basic theoretical knowledge of the course. In the class, the teacher uses the task-driven method and the on-line and off-line hybrid teaching method to implement the teaching [10]. 6502 electric centralized system maintenance training room, TYJL-II type computer interlocking system maintenance training room and DS6-K5B type computer interlocking system maintenance training room provide a real on-the-spot working environment for teaching implementation. By means of self-determination, cooperation and project-based learning, students accomplish their learning tasks in teaching, learning and doing, reconstruct their knowledge structure, acquire the ability to analyse and solve problems, and develop good professional quality. Before and after the application of the results of the teaching reform, the comparison of the data of the students' course evaluation shows that in terms of the mastery of basic knowledge, the scores have increased by 15% [11]. In terms of the mastery of skills, the scores have increased by 12%; In terms of professional accomplishment, there's an 11% improvement, as shown in figure 2

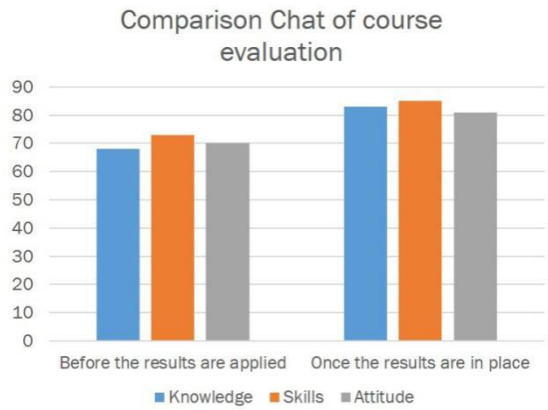

Figure 2 Comparison Chat of course evaluation.

In 2019, in the 11th National Transportation Industry Professional Skills Competition "Jie'an Cup" Urban Rail Transit Service (Student Group) signal maintenance professional skills competition in central China Hubei Province preliminary competition, the professional students won the group first prize. In the Chinese skills competition-the 11th National Transportation Industry Professional Skills Competition "Jie'an Cup" Urban Rail Transit Service (student group) signal maintenance professional skills competition, our students won the third prize.

4. CONCLUSION

In the course of teaching, we found the problems such as the inconsistency [12] between the curriculum content and work content, lack of advanced curriculum ideas, reasonable teaching design, high-quality curriculum resources, effective curriculum evaluation, being difficult to teach "Computer Interlocking System Fault Treatment". These problems seriously affect the enthusiasm and initiative of students in learning. We have innovated and practiced the education and teaching of the course "maintenance of urban rail transit interlocking system" by reconstructing the course content, renewing the course concept, optimizing the teaching design, constructing course resources and perfecting course evaluation, which effectively solve the above-mentioned problems, improve the quality of personnel training. The method of curriculum teaching reform has been adopted by more than 20 well-known Higher Vocational and technical colleges in China, such as Nanjing Railway Vocational and Technical College, Xi'an Railway Vocational and Technical College, Guangzhou Railway Vocational and technical college and Hunan High-speed Railway Vocational and technical college. The teaching effect is proved to be good, and the students' comprehensive vocational ability is greatly promoted.

AUTHORS' CONTRIBUTIONS

Xiping Yu, Lili Li contributed to the conception of the study, performed the experiment, contributed significantly to analysis and manuscript preparation, performed the data analyses and wrote the manuscript. Zhuoying, Zhou helped perform the analysis with constructive discussions.

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