

Research on the Path Strategy for Diagnosis and Improvement of Higher Vocational Railway Operation Major Curriculum Based on SOLO Theory

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Abstract: At present, China's railway industry has entered a new round of high-quality development, requiring more highly skilled talents in railway operation. In order to meet the talent cultivation needs of the industry, this article diagnoses the course "Receiving and Departing Train Work" in the railway operation major of Hunan Railway Vocational and Technical College based on SOLO theory. The results show that there are still unclear course objectives, untimely update and iteration of course content, and a relatively traditional teaching mode in this course. This article aims to improve students' job adaptability and proposes improvement paths and strategies for higher vocational railway operation professional courses from the perspectives of course objectives, teaching content, teaching methods, and teaching staff, aiming to address issues such as unclear differences in student learning content. The aim is to achieve the goal of improving course quality.

1. Introduction

The global energy shortage and the deterioration of the ecological environment have become a reality. As an environmentally friendly transportation tool, railways can effectively alleviate this problem. Currently, the railway industry has stronger advantages than any previous model by adopting modern technology. Faced with current opportunities and challenges, China's railway industry will enter a new round of high-quality development, requiring more railway professionals and highly skilled talents. As an important output unit of railway talents, vocational colleges are showing a decreasing trend in the matching between talent cultivation models and the development speed of the railway industry [1]. In order to cultivate talents who meet national vocational standards, meet the needs of the railway industry and economic development, and enhance the job abilities of graduates of railway related majors, this article starts from the course of "Receiving and Departing Train Work" in vocational railway operation majors, and based on the SOLO theory, makes diagnostic changes to the course. We hope that through curriculum reform, we can effectively match students' abilities with the job requirements of the railway industry, find highly targeted training paths for positions, and enable students to truly achieve zero distance employment and improve the quality of curriculum education.

2. Theoretical Basis for the Diagnosis and Reform of the Course "Receiving and Departing Train Work" in Railway Operations Major

2.1. The Main Idea of SOLO Classification Theory

This article explores the use of SOLO theory to construct the ability structure of railway operation students, in order to provide a theoretical basis for the diagnosis and reform of railway operation courses. The core theme of SOLO theory is to enable students' thinking and learning outcomes to be discovered [2]. This theory is further explored by Professor Biggs et al. on the basis of Piaget's development theory research. The theory is mainly used for the assessment and evaluation of students' learning outcomes, and is also applied to teaching or curriculum design in many research fields. The application of SOLO theory in this article is mainly reflected in the evaluation of teaching objectives, teaching achievements, and teaching feedback of vocational

railway operation courses, and ultimately determining the job adaptability structure that students need to master. The application of SOLO theory can to some extent enhance students' enthusiasm, analytical thinking ability, and work literacy, which have a high degree of compatibility with the employment requirements of the railway industry [3].

The five levels of SOLO theory can be summarized as follows: firstly, at the pre structural level, students at this stage are unable to understand problems and think about the working laws of railway trains, and their thinking level belongs to the lowest stage; The second is the single point structure hierarchy, where students at this stage can pay attention to the connection between questions and answers regarding course knowledge, but this connection is still too simple for analyzing practical problems; The third stage is the multi-point structure stage, where students can think about problem-solving methods from multiple perspectives of railway receiving and dispatching train work. For the problems raised in the course, they can choose multiple knowledge points to solve, but the solutions are all isolated and not interconnected with each other; The fourth stage is the correlation structure stage, where students can use a large number of knowledge points to answer the questions mentioned in the course of receiving and dispatching train work, but the answers are in the experience stage and cannot be well expanded; The fifth stage is the abstract expansion stage, in which students are not only able to use a large amount of professional knowledge of railway trains to solve problems, but also able to make correct assumptions about problems and use knowledge from other disciplines to solve the proposed problems.

At present, scholars such as Zhang Xiangwen believe that SOLO theory can help innovate teaching methods and provide assistance for course teaching from multiple perspectives [4]. Scholars such as Zhao Jianhua believe that SOLO theory can more effectively evaluate students' mastery of knowledge [5]. In the field of exam research, some scholars believe that SOLO theory can become a single basis for course exam questions [6]. Scholars such as Gao Lingbiao believe that the SOLO theory can serve as an evaluation basis for students' thinking transfer in open-ended answer questions when solving course test questions [7]. These studies all indicate that the SOLO theory has high practicality in evaluating students' abilities. Based on the SOLO theory, this article sorts out the job abilities of vocational railway operation students, making the evaluation of students more accurate.

2.2. Analysis of Job Abilities Related to Railway Receiving and Dispatching Trains

This article combines SOLO theory and compares the national professional standards for station duty officers and assistant duty officers to form five categories of abilities for train reception and departure positions. The five categories mainly consider the differences in students' work nature, practical operation ability, and professional knowledge learning [8]. The specific situation of the five categories of abilities is as follows:

One is the basic cognitive ability category of receiving and departing trains. Understand station routes, tracks, and turnout numbers; Basic principles of signal interlocking equipment; Basic knowledge of trains, sections, and train operation blocking methods for receiving and departing trains; The second is the scope of operational and operational capabilities for receiving and departing train equipment. Master the display significance of various indicator lights and light strips on the console, as well as the purpose, usage conditions, and operation methods of various buttons. Be able to handle trains, shunting routes, route unlocking, guiding reception, and departure in the opposite direction. The third is the range of train reception and departure capacity under normal circumstances. Proficient in the operation process and standards of dual track automatic block centralized interlocking, single track semi-automatic block centralized interlocking, and single track automatic inter station block centralized interlocking for receiving and departing trains; The fourth category is the capacity of receiving and dispatching trains in the event of equipment failure. Master the receiving and dispatching trains in case of telephone blocking without interlocking, track circuit, turnout, and annunciator failure; The fifth category is the capacity of receiving and departing trains with changes in operating conditions. Mastering the reverse direction of double tracks or switching to single track operation, non-arrival and departure line receiving and departure trains, and

receiving and departure of over length and over limit trains.

Through the above research, this study has identified the ability requirements that students in the "Train Reception and Departure Work" course of railway operation majors should have. The main direction of course improvement should revolve around enhancing students' abilities in these aspects, with the goal of cultivating students who are proficient in the above knowledge and skills. This lays a research foundation for the diagnosis and improvement of vocational railway operation professional courses [9].

3. The Current Situation and Dilemma of the Course "Train Reception and Departure Work" for Railway Operations Majors

3.1. Current Situation of the Course "Train Reception and Departure Work" for Railway Operations Majors

In order to gain a detailed understanding of the current basic situation of the "Train Reception and Departure Work" course in the railway operation major, this article uses questionnaire survey and interview methods to collect basic data of the course after consulting relevant materials and literature on the course construction of vocational colleges offering railway operation majors. The main content of the questionnaire includes course objectives, course content, course teaching methods, course evaluation methods, and student learning effects [10]. The survey targets students majoring in railway operation in vocational colleges, and the interview method targets frontline teachers, supervisors, and railway related experts and scholars. Currently, the course "Train Reception and Departure Work" mainly presents the following situations.

Firstly, in terms of course objectives, 69% of students believe that the course is of great significance for their future work and life, 27% of students believe that studying the course is for the purpose of obtaining relevant certificates in the future, and 4% of students believe that studying the course is only for the purpose of exams. Secondly, in terms of course content and job matching, 73% of students believe that the course is related to job requirements, but the correlation still needs to be improved. 7% of students believe that the correlation is poor, and 20% of students believe that the correlation between the two is closely combined. In terms of course teaching methods, 57% of the course content is taught through lectures, 38% of the course content is operated through practical training, and 5% of the course content is conducted through group discussions. In terms of course evaluation, 82% of course evaluations are based on mid-term and final exams, 15% are based on practical activities, and 3% are based on classroom participation to evaluate students' mastery of knowledge. In terms of the selection of teaching materials for the course, 42% of students strongly agree with the selected materials for this course, 50% of students believe that the content and practicality of the selected materials for this course are average, and 8% of students believe that the selected materials for this course are not suitable for the mastery of knowledge and abilities. In terms of student self-evaluation, 56% of students learn according to the teaching ideas of the course teacher, 20% of students actively participate in the teacher's teaching activities, 10% of students like to communicate with the teacher and participate in group discussion activities, 9% of students like to actively think and understand the teaching knowledge of the course, 5% of students think that the course content is boring or too simple, and do not participate in the course teaching activities.

3.2. Diagnosis Conclusion of the Course "Train Reception and Departure Work" for Railway Operations Majors

Based on the application of the diagnostic indicator system based on SOLO theory, it was found that there are the following problems in the course of "Train Reception and Departure Work" for railway operation majors:

Firstly, in terms of course objectives, the corresponding relationship between course objectives and graduate ability requirements is not very clear, and the expression level of course objectives and stage objectives is not clear. The design of learning outcomes cannot fully test the achievement of

course objectives and stage objectives.

Secondly, in terms of course content, the school's course content has not been integrated with the current social and industry needs, and cannot keep up with the times. Some of the course content is outdated or unsuitable, and the students trained by the school cannot match the latest technology and equipment in railway operation. Even the teaching content selected for the course has borrowed the content and models of undergraduate colleges. Considering the significant differences in talent cultivation between vocational colleges and ordinary undergraduate colleges, simply applying undergraduate course content to teaching vocational railway operation students in the theoretical part does not meet the industry job requirements.

Thirdly, in terms of course teaching methods, the vocational railway operation major courses of the school did not strictly cultivate talents in accordance with the integration of course certificates. From the requirements of railway stations and depots for employees, it can be seen that employers pay more attention to job knowledge and job abilities. The relevant professional qualification certificates largely explain the actual standards and work norms that the position needs to meet, however, the content of this course does not fully match the content of the vocational qualification certificate. In order to meet the employment needs of enterprises, students also need to seek additional training resources for more in-depth learning.

Fourthly, in terms of the teaching staff, the theoretical foundation of the teachers in the railway operation major of the vocational college is solid, but their practical abilities still need to be further improved. Their understanding of the regulations is not deep enough, and there are few on-site cases selected during the teaching process. The selected course materials are updated slowly, which cannot effectively follow the rapid development of railway operation technology. The proportion of "double qualified" teachers is relatively small, and there is a lack of regular training mechanism. The growth rate of teachers is relatively slow.

4. Strategies for Improving the Course of "Train Reception and Departure Work" for Railway Operations Majors in Higher Vocational Education

Firstly, in terms of improving the course objectives, through investigation and analysis of railway transportation stations and depots, the corresponding professional positions of the course are identified. Based on the promotion path of on-site train pick-up and departure from the initial position of signal officer and assistant duty officer to station duty officer, typical work tasks and job professional abilities of each position are determined, with knowledge skills literacy as the main line. Through knowledge and skills, processes and methods The three-dimensional goal design of professional literacy and values is reflected, and refined into a step-by-step learning goal for each module, from simple to complex. Gradually presenting learning tasks that cover knowledge and skills to students can help teachers and students understand the learning status in a timely manner, adjust course content and learning progress.

Secondly, in terms of improving course content, the teaching content of the course should meet the actual work needs and adopt modular design. Based on the course objectives, the knowledge and skills required for the positions related to receiving and dispatching trains are systematically organized. The main teaching content is organized into a knowledge tree structure, incorporating the latest computer interlocking technology, four display automatic blocking, and railway industry standards. Through online and offline sharing, discussion, animation demonstration, and other links, the course of receiving and dispatching trains is made more practical in terms of teaching content, Cultivate students' sense of responsibility, recognize the importance of this core professional course, and form the awareness of active learning.

Thirdly, in terms of improving teaching methods, differentiated teaching should be carried out in accordance with students' aptitude. Students majoring in railway operation in vocational colleges come from different educational channels and have different educational backgrounds. Through the verification of SOLO theory in the previous text, it can be seen that there are different levels of ability and thinking among students. The teaching method of the course should be based on the different levels of students for layered teaching, after the completion of the basic course teaching,

theoretical knowledge and practical operation ability evaluation tests can be conducted. According to the test results, students participating in the study of railway operation majors will be divided into three different classes: basic, intermediate, and advanced. The school will arrange different class times for different classes and conduct separate teaching for the three classes through class walking. At the same time, in order to cultivate students' mastery of good job knowledge and skills, the teaching method of job scenario simulation can be used, setting job tasks based on real railway operation scenarios to guide students to explore and analyze practical problems.

Fourthly, in terms of improving the teaching staff of the curriculum, the fundamental way to strengthen the effectiveness of railway operation professional curriculum improvement is to enhance the professional knowledge and practical operation ability of teachers. Based on the changes in curriculum objectives and teaching models, it is necessary to first strengthen the communication between railway operation professional course teachers, relevant professional teachers, and industry backbone. At the same time, teachers are encouraged to learn across disciplines, regularly hold research and teaching seminars, establish a professional course teacher workshop, analyze industry needs, curriculum standards, and research textbooks. At the same time, we will increase the practical efforts of railway operation professional teachers in enterprises, deeply understand the requirements of railway stations and depots for talents, and timely integrate the latest changes in job requirements for talents into curriculum teaching. Schools should formulate supporting incentive policies and systems for teacher enterprise practice, and enhance the enthusiasm of teachers to join enterprises.

5. Conclusions

Based on the perspective of SOLO theory, the curriculum objectives of higher vocational railway operation majors should be based on cultivating students' job adaptability. However, through investigation and research on railway operation majors in universities, it has been found that the current curriculum has problems such as unclear curriculum objectives, untimely updating and iteration of curriculum content, relatively traditional teaching models, and unclear differentiation of student learning content. After in-depth exploration of the diagnostic results of the curriculum, This article aims to improve students' job adaptability, starting from the aspects of course objectives, teaching content, teaching methods, and teaching staff, to improve the course of "Train Reception and Departure Work", hoping to achieve the expected goal of improving the quality of the course. Although this article proposes innovative curriculum improvement strategies, there are still insufficient research on the diagnosis and reform of vocational railway operation professional courses. Firstly, the investigation of the current situation of vocational railway operation professional courses is insufficient. This article only analyzes the curriculum situation of a certain vocational college, and the significance of promotion is still lacking; Secondly, the data analysis method used in this article is relatively simple, and the reliability and consistency of the data have not been verified; Finally, the improvement strategies proposed in this article for vocational railway operation majors have not been analyzed and verified in terms of actual effectiveness. In future research, the effectiveness of curriculum improvement strategies will be studied based on practical case studies.

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