

Teaching Reform of the 'Railway Traffic Organization' Course Based on the OBE Concept

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Abstract

To address issues such as unclear learning objectives, uneven learning outcomes, and single evaluation methods in the teaching of railway transportation operation management courses, this paper analyzes the reform approach of a blended teaching model under the Outcome-Based Education (OBE) concept. Taking the 'Railway Traffic Organization' course as an example, specific teaching reform proposals are put forward concerning course learning objectives, instructional content, teaching organization forms, and assessment methods. The paper also discusses the teaching outcomes achieved after implementing the reforms.

Keywords

Railway Transportation Operation Management; OBE Concept; Course Teaching Reform; Railway Traffic Organization.

1. Introduction

The OBE Concept is a student-centered educational philosophy that emphasizes clearly defining learning outcomes and designing the instructional process in reverse based on these outcomes [1]. By assessing learning outcomes, educators continuously adjust and optimize the educational process to ensure the efficient achievement of educational objectives. The blended teaching model integrates the advantages of both online and offline instruction. Compared to traditional methods, blended learning enables students to utilize online resources, allowing them to manage their learning schedule more independently and flexibly. During offline sessions, students can focus more on solving complex problems and practicing practical tasks, enhancing their learning efficiency. The integration of online and offline teaching enhances interaction and feedback between instructors and students, contributing to continuous improvement in teaching quality and establishing a more efficient and flexible instructional model.

With the accelerated modernization and informatization of the national railway system, significant changes have occurred in railway construction, operation, and management, raising higher standards for workforce quality. Research indicates that when recruiting employees, the National Railway Group considers not only theoretical knowledge and practical skills but also emphasizes personal qualities and professional competencies. Therefore, higher education institutions need to reform their professional course teaching models, implementing a holistic talent development approach that integrates knowledge, skills, and emotional growth, embedding the OBE concept into daily teaching practices.

Against the backdrop of undergraduate course accreditation in Guangdong Province and drawing on our university's experience in developing the 'Railway Traffic Organization' course, we have restructured the course objectives based on the OBE teaching concept. By analyzing existing issues and aligning with talent development standards, we have integrated 'job-course, competition-course, and certification-course' elements into the curriculum, effectively designing classroom instruction and achieving notable outcomes through these reforms.

2. Course Characteristics and Teaching Status

2.1. Course Characteristics

The Characteristics of Railway Transportation Operation Management Courses Are Reflected in the Following Aspects: Firstly, these courses emphasize problem-solving skills and impose high demands on students' overall competencies. Secondly, they focus on the close integration of theory and practice, requiring students to not only master comprehensive theoretical knowledge but also engage in substantial practical exercises to fully develop operational skills. Lastly, these courses foster divergent thinking by encouraging team discussions and brainstorming sessions to cultivate students' innovative thinking abilities. Therefore, railway transportation operation management courses set high standards for learning outcomes by emphasizing comprehensive skills development, combining theory with practice, and promoting innovation.

2.2. Teaching Status

Challenges and Issues in the Current Teaching Practice of the "Railway Traffic Organization" Course. The teaching practice of the *"Railway Traffic Organization"* course faces a series of challenges, primarily in three areas: students' learning attitudes, foundational disparities among students, and evaluation of learning outcomes. Firstly, many students feel uncertain about their future career development, resulting in unclear learning objectives. This directly leads to low interest in learning and a lack of sustained motivation. Secondly, significant disparities in students' foundational knowledge further complicate the learning process. Students with weaker foundations often give up when faced with difficulties, exacerbating the unevenness of learning outcomes. Lastly, the existing evaluation system overly emphasizes final examination results, neglecting the assessment of students' intermediate learning achievements. This approach not only fails to comprehensively reflect students' actual learning status but may also encourage cramming strategies for exams. As a result, the evaluation system neither accurately assesses students' progress nor effectively promotes their development. Given these challenges in the current teaching scenario, it is imperative to explore and implement more effective teaching strategies and evaluation mechanisms. These reforms should aim to stimulate students' interest in learning, enhance their resilience, and provide a comprehensive and fair assessment of their learning outcomes.

3. Overall ideas for the reform of blended learning mode based on OBE

In the context of railway transportation operation management courses based on the Outcome-Based Education (OBE) framework, it is crucial to clearly define the expected learning outcomes. These outcomes encompass not only specialized knowledge but also problem-solving skills and professional competencies. Upon completing the course, students should be able to apply their acquired knowledge to solve real-world problems in their professional roles. Additionally, they should demonstrate strong professional ethics, a sense of responsibility, and safety awareness, adhering to relevant regulations to ensure the quality and safety of maintenance operations. Based on these defined learning outcomes, we have implemented a backward design approach to structure the course objectives and content in the following two areas:

1. Establishing a Blended Teaching System

A blended learning framework is constructed by leveraging online platforms to provide micro-lectures, instructional animations, and supplementary materials, facilitating pre-class preparation and post-class review. Learning guides are developed to clarify tasks, highlight key concepts, and present exercises, guiding students in independent learning and self-assessment. Discussion forums encourage students to pose questions and share experiences, fostering interactive communication among peers and with instructors. During face-to-face sessions,

instructors focus on addressing the critical and challenging points identified in online learning. Practical sessions incorporate project-based learning, where students work in teams to complete various projects related to railway traffic organization. This process, from task requirements and solution design to implementation and evaluation, enhances their comprehensive application skills.

2. Providing Personalized Learning Support and Guidance

In terms of instructional strategies and evaluation mechanisms, students are encouraged to develop personalized study plans and schedule their learning flexibly based on their backgrounds and progress. Formative assessments, including online assignment completion and participation in discussions, are employed to monitor students' learning in real time and provide immediate feedback. A comprehensive assessment at the end of the course evaluates both theoretical knowledge and practical skills. To ensure objectivity and accuracy, observational checklists and other evaluation tools are introduced. This approach offers a holistic and fair assessment of students' learning outcomes, fostering both individual progress and academic excellence.

4. Reform and application of blended learning mode based on OBE

4.1. Optimize course learning objectives

The OBE-based reform of the ‘*Railway Traffic Organization*’ course centers on the core principle of ‘outcome orientation’. The primary step is to clearly define the learning outcomes that students need to achieve, and educators must establish specific and measurable instructional objectives. Through field research and visits to relevant enterprises, such as Guangzhou Railway Group and Guangzhou Metro Corporation, we identified the key competencies required for new employees. This data was synthesized into a talent development framework, from which the specific instructional objectives for this course were derived. The detailed content is presented in Table 1.

Table 1: Correspondence between Job Requirements and Course Teaching Objectives

Job Requirements	Knowledge objectives	Literacy goals
1. Develop a railway station work plan	Master the train receiving and dispatching work and technical station train planning, master the theory and methods of shunting work, master the station operation plan and dispatch command	Awareness of production safety operations. Sense of love and dedication to the job. Sense of responsibility for fulfilling job duties. Environmental protection awareness. Sense of professional integrity.
2. Develop a freight train formation plan	Master the direct train formation plan at the loading site and the technical direct train formation plan	Awareness of safety protection. Spirit of teamwork and collaboration. Good communication and interpersonal skills. Good psychological resilience and the ability to overcome difficulties. Ability to learn new knowledge independently. Ability to
3. Prepare train operation diagram	Master the structure, composition, and elements of train operation diagrams, as well as the principles and processes of computer-generated train operation diagram technology	

4. Develop railway transportation production technology plan	Master the connotation and preparation process of cargo transportation production plan, and master the connotation and preparation process of railway transportation production technology plan	independently develop and implement work plans
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4.2. Refactoring course teaching content

The course content should be closely aligned with the anticipated learning outcomes, constructed according to the principles of modularization and fragmentation^[2]. This approach enables students to clearly understand the outcomes they are expected to achieve upon completing the course, allowing them to effectively focus their attention on specific learning content. The detailed correspondence between course content and learning outcomes is presented in Table 2.

Table 2: Operational efficiency Evaluation of Nansha Port

Course learning output	Module Name	Module learning content
Familiar with preparing railway station work plans	Module 1: Railway Station Work Plan	The connotation of station work organization, train receiving and dispatching work and technical station train technical operations, the theory and methods of shunting work, the technical operations of cargo handling vehicles, station operation planning and scheduling command
Proficient in formulating railway freight train formation plans	Module 2: Freight train formation plan	The connotation of the freight train formation plan, the direct train formation plan for the loading site, and the preparation of the technical station train formation plan
Proficient in compiling train timetable	Module 3: Train timetable	Concept and classification of train operation diagram, elements of train operation diagram, railway section capacity, and preparation of train operation diagram
Proficient in preparing railway transportation production plans	Module 4: Transportation Production Technology Plan	Railway freight transportation production plan, railway transportation production technology plan, railway transportation scheme and scheduling command

4.3. Innovative teaching organizational forms

The OBE concept emphasizes a student-centered approach, aiming to fully harness students' initiative and creativity. In line with the characteristics of blended learning, we make full use of online teaching platforms, such as 'Xuexitong', to move the majority of theoretical content to the online space. To support knowledge objectives, various resources—such as texts, images, micro-lectures, and animations—are provided for students to preview before class. Additionally, foundational theoretical content is made available to help students identify and address any gaps in their understanding. The online platform also allows the collection of questions raised by students during their learning process and supports reinforcement of

course material after class. In contrast, the in-class sessions primarily focus on addressing key difficulties, clarifying challenging concepts, and assessing the completion of work tasks. A specific breakdown of the teaching organization and methods is shown in Figure 1.

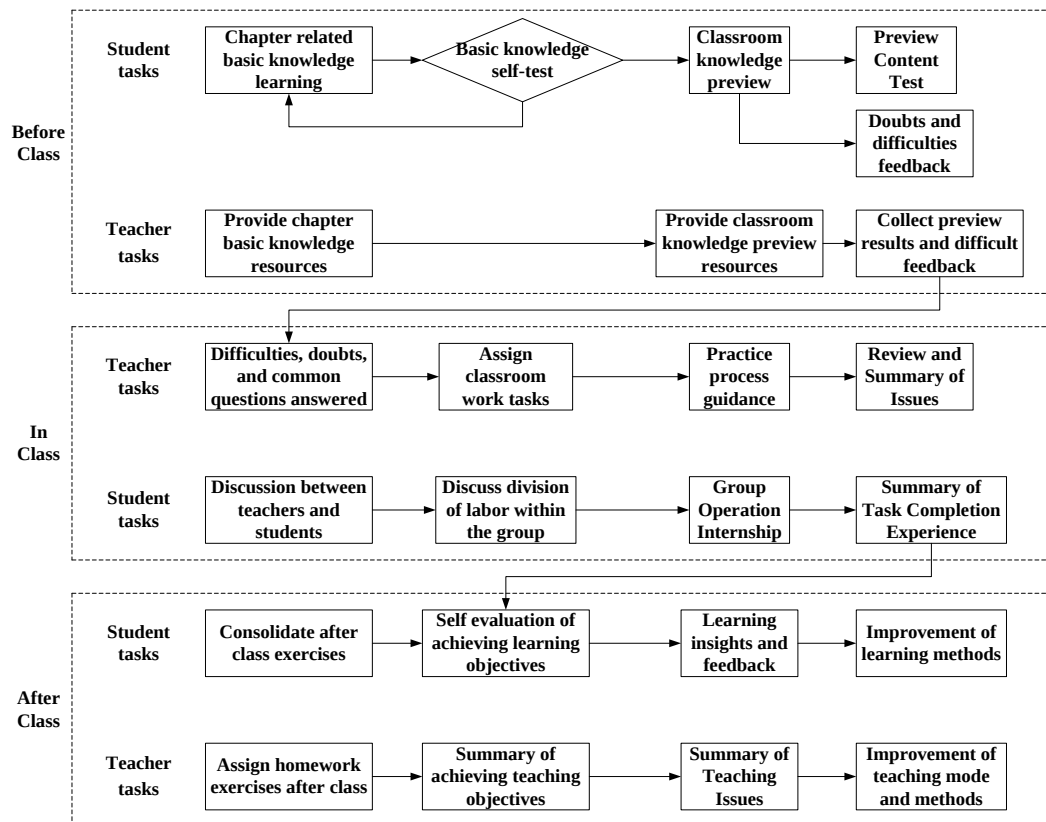


Figure 1: Teaching organization and implementation methods

4.4. Diversified assessment and evaluation throughout the entire process

To ensure the continuity of students' learning and the achievement of learning outcomes, immediate, process-based evaluation is emphasized. Student assessment focuses on their intermediate learning achievements, and feedback from evaluation results allows students to clearly understand their progress. This approach fosters a learning process driven by evaluation. For the continuous improvement of educational quality, it is essential to regularly collect feedback from students, data on teaching effectiveness, and results from post-course assessments. This feedback loop helps adjust and optimize the teaching model to promote enhanced teaching practices through evaluation.

To achieve objective and accurate evaluation, a diversity of assessment methods should be employed. Online quizzes allow students to self-assess their grasp of online content, while metrics such as resource engagement and completion rates of online exercises can serve as motivational tools for students to stay on track. During offline practical sessions, task implementation observation checklists can enable peer evaluations. Instructors will then conduct a comprehensive assessment of students' online learning, offline task completion, and final evaluation results. Additionally, students are encouraged to participate in professional skill competitions, innovation and entrepreneurship contests, and other activities that reflect their practical abilities, with competition results contributing to their final course grades.

5. Analysis of Reform Effectiveness

To validate the effectiveness of the teaching reform, a selected class of students has been chosen each year starting from the 2019 cohort for the reform experiment. Based on the students' final semester grades, course evaluations, and performance in competitions, significant improvements have been observed in their learning enthusiasm, academic outcomes, and overall practical abilities. Detailed results are presented in Table 3 and Table 4.

Table 3: Distribution of grades among experimental class students from 2019 to 2021

	90-100	80-89	70-79	60-69	<60
2019	3	13	11	9	0
2020	5	18	8	6	0
2021	9	14	7	5	0

Table 4: Course evaluation in the past three semesters

Course Year	2021-2022	2022-2023	2023-2024
Student evaluation score	92.5	94.2	96.3
Teaching quality score	90.2	95.1	95.8

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