

# Research on the Construction of Indicator System for Diagnosis and Improvement of Urban Rail Transit Majors in Higher Vocational Education Based on OBE Concept

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**Abstract:** With the continuous growth of vocational urban rail professional courses, the content of some evaluation systems for vocational urban rail professional courses is not in line with the talent needs of the urban rail industry and the practice of education and teaching reform. In order to solve the practical contradiction between certain indicators in the current curriculum diagnosis index system of urban rail transit majors in vocational colleges and the school's training objectives, this article takes the current implementation status of urban rail transit majors in three vocational colleges in Hunan Province as the research object, and uses the OBE concept as theoretical support to comprehensively study the content and results of curriculum diagnosis for urban rail transit majors in vocational colleges. The research results indicate that (1) the diagnosis and improvement of curriculum objectives have the greatest impact on the diagnosis and improvement of urban rail transit majors in vocational colleges, and (2) there is a positive impact between curriculum objectives and curriculum standards, and the impact is significant. (3) The key factors that directly affect the diagnosis and improvement of urban rail specialty courses in vocational colleges include course positioning, course learning outcomes, faculty structure, and evaluation of learning outcomes.

## 1. Introduction

In vocational education, the role of curriculum in talent cultivation is particularly significant. In September 2020, the Ministry of Education and nine other ministries proposed to deepen the diagnosis and improvement of teaching work in vocational colleges, raising the importance of curriculum to an unprecedented level. This also urged various vocational colleges to increase the scientific diagnosis of curriculum and strengthen improvement efforts to address the problems existing in the curriculum. However, due to the fact that the curriculum diagnosis and improvement work in various vocational colleges has just started, the relevant diagnosis and improvement indicator system lacks standardization and systematicity. Therefore, constructing a scientific and objective curriculum diagnosis and improvement indicator system is of great practical significance. Based on this, this article explores relevant research in the curriculum of urban rail transit majors in vocational colleges based on the OBE concept. It is hoped that by establishing a scientific diagnostic and improvement indicator system, it can provide reference for the development of professional courses in vocational colleges.

In terms of OBE related research, scholar Xie Yanjuan earlier elaborated on foreign OBE theories, providing detailed explanations on the relevant models of OBE courses and how to apply them in domestic courses[1]. During the process of studying OBE theory, Sun Jing analyzed the potential problem of insufficient learning outcomes in the certification of engineering education related majors in China, and proposed a method path with a result oriented evaluation goal to address this issue[2]. Based on their own work experience and OBE theory, scholars such as Gao Yufei compared the quality of courses in China and New Zealand, and constructed an evaluation system for vocational professional courses based on the comparative evaluation results[3]. During the process of studying OBE theory, scholars such as Wang Yongquan explained in detail the issues

of curriculum elements, teaching environment, and talent cultivation effectiveness in the curriculum quality evaluation system[4]. Scholars such as Yan Lihong believe that the course quality evaluation system should be established in three aspects: learning, teaching, and implementation effectiveness when studying the principles and applications of single-chip microcontrollers. They have also provided relevant explanations based on actual investigation and research[5].

In terms of research on curriculum diagnosis and improvement, Wang Juan believes that the diagnosis of vocational and technical courses should mainly focus on five aspects, including goal completion, reserve of curriculum resources, employment security for students, generation of curriculum quality, and effective control of curriculum quality[6]. Scholars such as Ding Caicheng believe that diagnosis and improvement work should mainly focus on students' comprehensive training and growth and development goals when researching topics related to curriculum diagnosis and improvement[7]. Scholars such as Tan Xiangqun have conducted research on the diagnosis and reform of vocational courses based on the construction of information platforms, and believe that a comprehensive curriculum teaching process with curriculum objectives, standards, and task systems should be established[8]. Hong Xuedi believes that in the process of researching courses in the field of foundation and foundation engineering construction and quality inspection, it is necessary to diagnose course construction based on course development, implementation, and teaching situation, and propose improvement measures based on actual data[9].

In summary, domestic scholars' research on curriculum diagnosis and improvement has become increasingly mature and rational. Most scholars believe that curriculum improvement is an important way to promote continuous improvement of the curriculum and a key element in talent cultivation. However, it is not difficult to find that for the relevant research on curriculum diagnosis and improvement in foreign countries, most of the research in this field by domestic scholars is theoretical research, and few scholars have conducted research based on the construction of curriculum evaluation indicator systems or curriculum operation guarantee mechanisms. There is no research that combines actual majors and does not have reference significance. Based on this, this article is based on the OBE theoretical perspective, Explore the construction of a curriculum diagnosis and improvement indicator system for urban rail transit majors in vocational colleges, in order to construct a new model for curriculum diagnosis and improvement in vocational colleges.

## **2. Definition of the Research Scope and Selection of Key Factors for the Diagnosis and Improvement of Urban Rail Transit Majors in Higher Vocational Education**

### **2.1. Definition of Course Diagnosis and Improvement Scope for Urban Rail Transit Majors in Higher Vocational Education**

Under the comprehensive definition of OBE theory, this article defines the scope of curriculum diagnosis and improvement for urban rail transit majors in vocational colleges. In this theory, it is believed that talent cultivation should be based on meeting social development, local prosperity, school growth, and student employment, in order to cultivate students' knowledge, skills, and professional literacy that can meet the needs of all parties. At the same time, it is necessary to provide students with conditions and guarantees for learning and employment according to the training objectives, therefore, the diagnosis and improvement of urban rail transit courses in vocational colleges should be evaluated around the above content.

### **2.2. Selection of Key Factors for Diagnosis and Improvement of Urban Rail Transit Majors in Higher Vocational Education**

This article adopts a combination of quantitative and qualitative methods to select the key factors for the diagnosis and improvement of urban rail transit professional courses in vocational colleges. By searching for "Course Diagnosis and Improvement" on CNKI, a total of 140 relevant literature were retrieved. After carefully studying the core content of each literature, 112 were ultimately selected for statistical induction of the influencing factors for course diagnosis and improvement. According to course objectives, course standards Key factors related to the teaching staff and

curriculum implementation will be extracted from four aspects. At the same time, based on the opinions and suggestions of relevant scholars and experienced practitioners in the field of urban rail transit in vocational colleges, the factors that affect the diagnosis and improvement of urban rail transit courses in vocational colleges will be determined in accordance with the above four aspects, as shown in Table 1.

Table 1 Factors influencing the diagnosis and improvement of urban rail transit courses in vocational colleges

Potential dependent variable	Measurement variables	Code name
Course Objectives (KCMB)	Course positioning: Does the course keep up with the development needs of the times.	KCMB1
	Stage goal: Does the course meet the cognitive needs of students in this major.	KCMB2
	Learning outcomes: whether the course objectives meet the talent needs of the local area.	KCMB3
Curriculum Standards (KCBZ)	Course resources: Does the course highlight the characteristics of the major.	KCBZ1
	Course proportion: Has the course set up reasonable compulsory and elective subjects.	KCBZ2
	Course Integrity: Does the course content have coherence and completeness.	KCBZ3
	Course practicality: Does the course cultivate students' innovative and creative abilities.	KCBZ4
	Course differentiation: Does the course specifically consider student personalization.	KCBZ5
Teaching staff (SZDW)	Teacher training: Is there a mature mechanism for cultivating a teaching staff.	SZDW1
	Teacher structure: Does the teaching staff have reasonable knowledge and experience.	SZDW2
	Teacher level: Does the teaching team have corresponding teaching achievements.	SZDW3
Course Implementation (KCSS)	Teaching elements: Are the curriculum plan and teaching outline prepared and complete.	KCSS1
	Teaching methods: Does the course attach importance to updating teaching methods and methods.	KCSS2
	Quality monitoring: whether the course teaching has undergone reasonable quality monitoring.	KCSS3
	Student evaluation: whether students have made a reasonable evaluation of the course.	KCSS4
	Employers' evaluation: whether the employment situation of students and feedback from employers are good.	KCSS5

### 3. Structural Equation Model and Data Analysis for Course Diagnosis and Improvement of Urban Rail Transit Majors in Higher Vocational Education

#### 3.1. SEM

This article uses Structural Equation Modeling (SEM) to model and analyze the diagnosis and improvement of urban rail transit courses in vocational colleges. Among them, there are many factors that affect the diagnosis and improvement of courses, and there are many connections between each influencing factor. The evaluation of factors also generates evaluation errors in the statistical process. However, the Structural Equation Modeling can balance the impact of errors, making the evaluation model have good consistency with the actual evaluation situation.

Rong Taisheng proposed in his research on structural equation modeling that in establishing an evaluation index system model, the path of each factor should be explained[10]. Therefore, this

article proposes the following assumptions based on the actual situation:

H1: The more reasonable the course objectives are set, the more effective the diagnosis and improvement of the course can be achieved;

H2: The more scientific the curriculum standards are, the more effective the diagnosis and improvement of the curriculum can be achieved;

H3: The more complete the allocation of teaching staff, the more effective it is to achieve course diagnosis and improvement;

H4: The more ideal the implementation effect of the course, the more effective the diagnosis and improvement of the course can be achieved.

### **3.2. Data Sources**

When designing the questionnaire, this article drew on the opinions of relevant scholars in the professional field and consulted a large amount of literature. Based on the conceptual model and measurement variable index system of impression factors for diagnosis and improvement of urban rail transit courses in vocational colleges, relevant questionnaires were developed. The questionnaires were distributed through questionnaire stars and on-site interviews, mainly to professors and scholars related to urban rail transit majors in vocational colleges Senior practitioners and outstanding student representatives in this industry. The questionnaire was evaluated and scored using Likert's 5-level scale method, with "1" indicating that the influencing factor has the smallest impact on course diagnosis and improvement, and "5" indicating that the influencing factor has the greatest impact on course diagnosis and improvement. A total of 320 questionnaires were distributed in this survey, of which 298 were valid, with a questionnaire effectiveness rate of 93.1%.

### **3.3. Reliability and Validity Analysis**

This article analyzes and tests the relevant data of the questionnaire survey through factor analysis in SPSS 22.0 software. The analysis results show that the KMO value of this questionnaire is 0.895, close to 1, indicating a good correlation between the relevant variables of the questionnaire and suitable for factor analysis. The Bartlett's spherical test value of the questionnaire is 0.000, indicating a significant correlation among the variables in this study. At the same time, the test results also indicate that the questionnaire has good convergent validity. The software also tested the reliability of the scale, and the test results showed that the overall Cronbach's  $\alpha$  The value is 0.859, >0.6, with a high reliability coefficient, and Cronbach's for each potential variable  $\alpha$  The values are all above 0.6, indicating that this scale has high reliability and consistency.

## **4. Structural Equation Model Analysis**

### **4.1. Structural Equation Model Validation**

This article constructs a structural equation model based on the diagnosis and improvement of urban rail courses in vocational colleges. The parameters of each variable are estimated using Amos 22.0 software, and the internal connections between each variable are analyzed based on the degree of agreement between the first and second level indicators. Finally, the model is determined to fit, and a confirmatory factor analysis structural equation model is constructed.

Referring to the research of scholars such as Haier on structural equation models, the error items in parameter estimation mainly include two aspects: firstly, there is a negative error variance, and secondly, the value of the normalization coefficient is greater than 0.95. In the confirmatory factor analysis structural equation model of the first-order model for the diagnosis and improvement of vocational urban rail courses constructed in this article, there is no case of negative error variance or a standardization coefficient greater than 0.95, indicating that this model can be tested for second-order models, and the model is shown in Figure 1. Meanwhile, all the indicators in the model indicate good fit, with CFI values of 0.963 > 0.9, RMSEA values of 0.057, < 0.08, GFI values of 0.927 > 0.9, CMIN/DF values of 1.964 < 2, and NFI values of 0.927 > 0.9. Moreover, the prior

relationship numbers of the four primary indicators all reached a significant level of 0.05, indicating that there are higher dimensional influencing factors between the four potential variables. Therefore, This article attempts to conduct confirmatory factor analysis of second-order models.

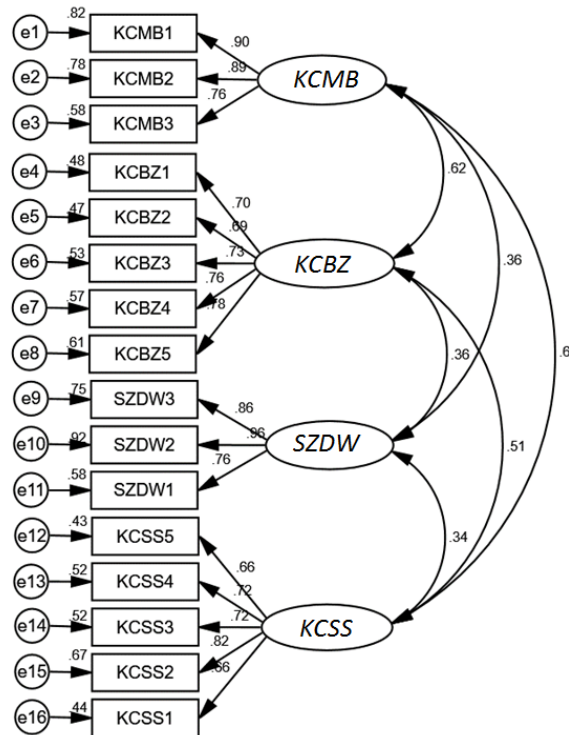


Figure 1 Diagnosis and Improvement of Curriculum for Urban Rail Transit Majors in Higher Vocational Education: A First Order Model Validation Factor Analysis Structural Equation Model

The results of the survey questionnaire were incorporated into the second-order model confirmatory factor analysis structural equation model for diagnosis and improvement of urban rail courses in vocational colleges for analysis. The relevant results are shown in Figure 2 and Table 2.

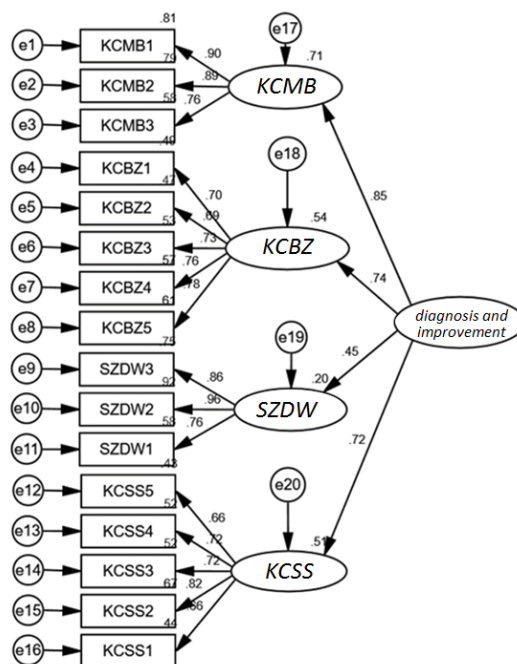


Figure 2 Diagnosis and Improvement of Curriculum for Urban Rail Transit Majors in Higher Vocational Education: A Second-order Model Validation Factor Analysis Structural Equation Model

Table 2 A Diagnosis and Improvement of Curriculum in Urban Rail Transit Majors in Higher Vocational Education: Structural Equation Model and Results

Statistical test	RMSEA	CMIN/DF	CFI	GFI	PGFI
Adaptation standards	<0.08	(1.3)	>0.9	>0.9	>0.5
Inspection results	0.056	1.938	0.963	0.926	0.681

#### 4.2. Analysis of Model Results

Based on the fitting results in Table 2, it can be seen that the degree of fitting of the model and the parameter estimation of each indicator show significant differences, indicating that the relevant assumptions in the previous text are valid. Combining the data results in Figure 1 and Figure 2, this article analyzes the diagnostic and improvement indicator system for urban rail courses in vocational colleges as follows.

(1) The impact of curriculum objectives, curriculum standards, teaching staff, and curriculum implementation on the diagnosis and improvement of urban rail transit professional courses in vocational colleges is 0.85, 0.74, 0.45, and 0.72, respectively. Among them, three indicators exceed 0.5, and one indicator approaches 0.5, indicating that the impact of each indicator on course diagnosis and improvement is relatively significant. Therefore, in the process of diagnosis and improvement of urban rail transit professional courses in vocational colleges, We need to strengthen the improvement level of various indicators to improve the quality of the professional courses, with special attention to strengthening the improvement level of course objectives.

(2) In the diagnosis and improvement of courses for urban rail transit majors in vocational colleges, the degree of impact of course objectives on course standards is 0.62, indicating a significant positive correlation between the two. This indicates that course objectives have a significant impact on the improvement of course standards. If scientific and reasonable course objectives are set, the course standards will also be correspondingly improved. Therefore, when setting course objectives, it is necessary to consider the development needs of the times The understanding of students in this major and the demand for industry talents should be carried out, and the diagnosis and improvement of vocational urban rail transit courses should be strengthened from both direct and indirect aspects.

The analysis of the results of each secondary indicator is as follows:

(1) In terms of course objectives, course positioning (whether the course closely follows the development needs of the times), stage objectives (whether the course meets the cognitive needs of students in this major), and learning outcomes (whether the course objectives meet the talent needs of the local area) have a significant impact on the diagnosis and improvement of course objectives, which are divided into 0.9, 0.89, and 0.76, combined with OBE theory, Whether students can better learn knowledge and skills that meet the needs of industry enterprises will determine whether the course objectives are set reasonably.

(2) In terms of curriculum standards, curriculum resources, curriculum proportion, curriculum integrity, practicality, and differences all have a significant impact on curriculum standards, with path coefficients of 0.7, 0.69, 0.73, 0.76, and 0.78, respectively. The most influential factor is whether the curriculum considers student personalization in a targeted manner. Therefore, in the setting of curriculum content, it is necessary to take into account the overall level of the majority of students, We should set different training goals based on the development needs of students, and promote their personalized development while ensuring their comprehensive development.

(3) In terms of the teaching staff, the teacher structure has the greatest impact, with a path coefficient value of 0.96. Whether teachers possess knowledge and experience in talent cultivation will directly determine whether students can learn modern, socialized, and market-oriented ideas and skills. Therefore, in the process of curriculum diagnosis and improvement, it is necessary to focus on improving teachers' shortcomings in teaching methods and increasing learning efforts.

(4) In terms of curriculum implementation, all indicators have shown significant results. OBE theory emphasizes the need to cultivate students who can adapt to the needs of industry enterprises.

During the process of receiving vocational education, students should increase practical courses and teaching content as much as possible, so that the courses can meet the needs of students' growth and development on the one hand, and also meet the needs of society on the other hand, thereby improving the satisfaction of students and society with education and teaching.

## 5. Conclusions

This article uses a structural equation model to consider the correlation and coupling of different dimensions in the diagnosis and improvement of urban rail transit courses in vocational colleges. After systematic analysis, the following conclusions are drawn:

(1) The analysis of curriculum diagnosis and improvement in vocational urban rail majors based on structural equation modeling shows that the diagnosis and improvement of curriculum objectives have the greatest impact on the diagnosis and improvement of vocational urban rail majors, while the diagnosis and improvement of teaching staff have a relatively small impact;

(2) The factor molecular system in the model reflects the correlation between the diagnosis and improvement of urban rail transit courses in vocational colleges, and the course objectives and standards have a positive and significant impact.

(3) The standardized path coefficient of the model indicates that whether the curriculum keeps up with the development needs of the times, whether the curriculum conforms to the cognition of students in this major, whether the teaching staff has reasonable knowledge and teaching experience, and whether students evaluate the curriculum reasonably are the key factors that ultimately directly affect the diagnosis and improvement of urban rail transit majors in vocational colleges.

This article assumes path impact based on professional knowledge, but further confirmatory analysis is still needed for this structural equation model. In future research, we will delve deeper into the frontline of course teaching and continuously improve the diagnostic and improvement indicator system of the course.

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