

# Research on the Application of the “Three-Dimensional Integration” Teaching Model in the Course “Urban Rail Transit ATC System”

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## Abstract

With the vigorous development of the urban rail transit industry, higher requirements have been placed on professionals' mastery of specialized knowledge and ideological-political literacy. This paper innovatively proposes a “Three-Dimensional Integration” teaching model and applies it to the course “Urban Rail Transit ATC System”. This model skillfully integrates ideological and political elements through three dimensions: knowledge impartation, practical operation, and campus culture. Empirical research shows that this model can effectively improve students' professional competence and ideological-political literacy, providing valuable references for the ideological-political education reform in rail transit specialty courses.

## Keywords

Three-dimensional integration teaching model; Urban Rail Transit ATC System; Curriculum-based ideological and political education.

## 1. Introduction

### 1.1. Research Background

In recent years, China's urban rail transit construction has experienced explosive growth, with continuous line extensions and increasing operational mileage, leading to a sharp rise in demand for professionals [1]. As a core course for rail transit signaling and control majors, the traditional teaching of “Urban Rail Transit ATC System” often focuses on imparting professional knowledge (such as ATC system composition, working principles, and signal control processes) while neglecting the cultivation of students' ideological-political literacy [2]. However, under the educational concept of “Fostering Virtue Through Education”, merely possessing solid professional knowledge can no longer meet the industry's demand for high-quality talents. Deeply integrating ideological-political education into professional course teaching and achieving organic integration of professional knowledge and ideological-political education has become key to improving the quality of rail transit professional talent cultivation.

### 1.2. Research Purpose and Significance

This study aims to explore the specific application methods and effects of the “Three-Dimensional Integration” teaching model in the course “Urban Rail Transit ATC System”. By integrating ideological-political elements through three dimensions—knowledge impartation, practical operation, and campus culture—it can not only enrich course teaching content but also enhance students' professional competence and ideological-political literacy, promoting their comprehensive development. Meanwhile, this research provides new ideas and practical experience for the ideological-political teaching reform of rail transit specialty courses, helps improve the teaching quality of the entire specialty, and cultivates rail transit professionals with both excellent professional skills and noble ideological-political qualities.

## 2. Theoretical Basis of the "Three-Dimensional Integration" Teaching Model

### 2.1. Constructivist Learning Theory

Constructivist learning theory emphasizes that learners are not passive recipients of knowledge but active constructors of knowledge during the learning process [3]. Teachers play the roles of guides and facilitators in this process by creating learning situations closely related to real life to guide students to actively participate in discussions and inquiry activities. In the course "Urban Rail Transit ATC System", teachers can create problem scenarios based on actual cases, such as ATC system failures during peak hours causing train delays, allowing students to analyze possible causes and propose solutions. This teaching method can stimulate students' learning interest and initiative, prompting them to independently construct professional knowledge and ideological-political literacy. For example, when analyzing failure causes, students can appreciate the importance of safety awareness and responsibility, thereby subtly improving their ideological-political literacy.

### 2.2. Humanistic Education Theory

Humanistic education theory focuses on students' comprehensive development, emphasizing student-centered approaches, respecting students' individuality and needs, and cultivating students' emotions, attitudes, and values [4]. The "Three-Dimensional Integration" teaching model fully embodies this theory. Teachers not only pay attention to students' mastery of professional knowledge but also focus on cultivating students' comprehensive qualities such as teamwork ability, innovative thinking, and rigorous scientific attitudes, as well as ideological-political qualities such as safety awareness, national pride, and social responsibility. Through diversified teaching activities such as group projects, experimental operations, and academic lectures, students are provided with opportunities to showcase themselves and realize their self-worth, promoting their comprehensive development.

## 3. Specific Implementation of the "Three-Dimensional Integration" Teaching Model in the Course

### 3.1. Integration of Knowledge Impartation and Ideological-Political Elements Course Introduction

At the beginning of the course, teachers can demonstrate accident cases caused by ATC system failures, such as a subway collision in a certain city due to ATC system signal errors, resulting in serious casualties and property losses [5]. This guides students to analyze accident causes, helping them deeply understand the importance of ATC system safe operation, thereby cultivating their safety awareness and sense of responsibility. Meanwhile, teachers can introduce the development process of China's signal systems from technology introduction to independent innovation, describing the efforts and achievements of Chinese researchers in this process to stimulate students' national pride and patriotic sentiment and cultivate their sense of social responsibility [6].

### 3.2. Integration of Practical Operation and Ideological-Political Spirit

(1) Experiment Design: Teachers design targeted experimental projects based on course content and teaching objectives, incorporating requirements for teamwork, innovative thinking, and rigorous scientific attitudes during experiments. For example, an experimental project on ATC system fault diagnosis and troubleshooting can be designed, requiring students to work in groups. Each group member has clear responsibilities: some are responsible for data collection, some for fault analysis, and others for solution formulation and implementation. Through

group tasks, students' teamwork ability is cultivated. Students are encouraged to propose different fault diagnosis ideas and solutions to stimulate innovative thinking. Meanwhile, students are required to strictly follow experimental operating procedures and carefully record experimental data to cultivate rigorous scientific attitudes [7].

(2) Teamwork: During experiments, teachers should form groups reasonably, ensuring complementary knowledge levels and skills among group members. Each member's responsibilities should be clarified to guide students to collaborate and support each other in solving experimental problems. Through teamwork, students can not only improve their professional skills but also learn to communicate and cooperate with others, cultivating good team spirit and communication skills [8].

(3) Experiment Evaluation: A diversified evaluation method is adopted to comprehensively assess students' experimental performance. Evaluation content includes not only mastery of professional knowledge (such as understanding of ATC system principles and accuracy of fault diagnosis) but also teamwork ability, innovative thinking, and rigorous scientific attitudes. Evaluation results should be promptly fed back to students, affirming their strengths and progress while pointing out existing problems and shortcomings and providing improvement suggestions to stimulate their learning enthusiasm and initiative [9].

### 3.3. Integration of Campus Culture and Ideological-Political Atmosphere

(1) Academic Lectures: Themes related to rail transit specialties and ideological-political education are determined, such as "Development Trends of Urban Rail Transit and Talent Cultivation" and "Technological Innovation and Patriotic Spirit in the Rail Transit Field" [10]. Industry experts, scholars, or enterprise technical backbones are invited to give lectures. Students are organized to actively participate in lectures and discuss and summarize their gains and insights afterward. Academic lectures can broaden students' horizons, help them understand the latest industry trends and development directions, and cultivate their patriotic sentiment and innovative spirit.

(2) Technology Competitions: Challenging and practical competition projects are determined, such as the "Urban Rail Transit ATC System Design and Innovation Competition" [11]. Competition notices are released, clearly stating rules and requirements. Necessary guidance and training are provided to students, including professional knowledge explanations, experimental skill training, and innovative thinking method guidance. Students are organized to participate in competitions and encouraged to fully utilize their creativity and teamwork ability. Outstanding teams and individuals are recognized and rewarded to stimulate students' competitive awareness and innovative spirit.

(3) Cultural Activities: Cultural activities with rail transit specialty characteristics are planned, such as the "Rail Transit Culture Festival" and "ATC System Model Making Competition" [12]. These activities create a strong campus cultural atmosphere, allowing students to experience the charm of rail transit culture in a relaxed and pleasant environment. Activity achievements, such as outstanding student works and competition award-winning works, are displayed to enhance students' sense of achievement and self-confidence and cultivate their cultural literacy and aesthetic ability.

## 4. Empirical Research on the Application Effects of the "Three-Dimensional Integration" Teaching Model

### 4.1. Experimental Design

(1) Experimental Subject Selection: Two parallel classes are selected as experimental subjects, with one class as the experimental class (using the "Three-Dimensional Integration" teaching model) and the other as the control class (using traditional teaching methods). Before the

experiment, tests are conducted on both classes' students' professional knowledge and ideological-political literacy to ensure initial condition consistency [13].

(2) Experimental Variable Control: During teaching, both classes use the same teaching syllabus and materials to ensure teaching content consistency. The experimental class strictly follows the "Three-Dimensional Integration" teaching model, integrating ideological-political elements through three dimensions, while the control class uses traditional teaching methods focusing on professional knowledge impartation. The experiment lasts one semester, with other potential influencing variables (such as teaching time and environment) strictly controlled during teaching [14].

(3) Experimental Process Monitoring: Throughout teaching, both classes' teaching situations are fully monitored. Teaching progress and method implementation are regularly checked to ensure the experimental class follows the predetermined teaching model. Meanwhile, students' learning status and effects are observed, and problems and difficulties encountered during learning are promptly identified and addressed with corresponding guidance and assistance [15].

#### 4.2. Data Collection and Analysis

(1) Data Collection Methods: After teaching, tests on professional knowledge and ideological-political literacy are conducted for both classes. Professional knowledge tests use closed-book exams covering ATC system basic principles, signal control technology, and fault diagnosis and troubleshooting. Ideological-political literacy tests use questionnaires covering safety awareness, responsibility awareness, teamwork ability, innovative thinking, national pride, and social responsibility [16].

(2) Data Analysis Methods: Descriptive statistics analyze both classes' test scores to understand overall performance in professional knowledge and ideological-political literacy. Independent sample t-tests compare differences in test scores between the experimental and control classes to determine whether the "Three-Dimensional Integration" teaching model's impact on students' professional and ideological-political literacy is significant [17].

(3) Experimental Results: Data analysis shows that the experimental class's professional knowledge and ideological-political literacy test scores are significantly higher than the control class's ( $p < 0.05$ ), indicating the "Three-Dimensional Integration" teaching model can effectively improve students' professional and ideological-political literacy.

#### 4.3. Results Discussion

(1) Enhancement of Professional Literacy: The "Three-Dimensional Integration" teaching model stimulates students' learning interest and initiative through three dimensions' synergistic effects. Knowledge impartation with actual cases and ideological-political elements helps students deeply understand professional knowledge application and importance; practical operation through group cooperation and project practice improves students' professional skills and problem-solving ability; campus culture activities broaden students' horizons and cultivate innovative thinking and teamwork ability. These factors jointly promote students' professional literacy improvement [18].

(2) Enhancement of Ideological-Political Literacy: The model integrates ideological-political education into professional courses through various forms, cultivating students' comprehensive qualities such as safety awareness, responsibility awareness, teamwork ability, innovative thinking, national pride, and social responsibility. For example, course introductions and experiments use accident case analysis and teamwork projects to help students deeply understand safety and responsibility importance; academic lectures and technology competitions stimulate national pride and innovative spirit; campus culture activities cultivate teamwork ability and cultural literacy.

(3) Experimental Result Implications: The results show the "Three-Dimensional Integration" teaching model significantly improves students' professional and ideological-political literacy. Therefore, this model is worth promoting and improving in rail transit specialty courses. During promotion, professional and ideological-political integration should be strengthened, course ideological-political elements should be further explored, and teaching models and methods should be optimized. Meanwhile, empirical research scope should be expanded to verify the model's universality and effectiveness for different grades and majors.

## 5. Conclusions and Prospects

### 5.1. Research Conclusions

This research applies the "Three-Dimensional Integration" teaching model in the course "Urban Rail Transit ATC System" and conducts empirical research. Results show this model can comprehensively and effectively improve students' professional and ideological-political literacy. While mastering professional knowledge, students' ideological-political literacy (such as safety awareness, responsibility awareness, and teamwork ability) also significantly improves.

### 5.2. Research Prospects

Future work should further optimize and improve the "Three-Dimensional Integration" teaching model. Ideological-political elements in rail transit specialty courses should be further explored and more closely integrated with professional knowledge. Industry-university cooperation should be strengthened by inviting enterprise experts to participate in course construction and teaching, helping students better understand industry demands and enterprise practices. Industry trends and technological developments should be closely followed to update teaching content, making courses more practical. Meanwhile, empirical research scope should be expanded by applying this model to more professional courses, providing references for ideological-political teaching reform in more courses.

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