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Research on the Path of Industry - Education Integration Teaching Reform of "Traffic Control and Management" under the Background of New Engineering

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Summary: ***To address the problem of disconnection between theory and industry practice in the course "Traffic Control and Management" , and to meet the requirement for application-oriented talents driven by intelligent transportation development, this paper takes Integration of industry and education as the core approach, combines the OBE concept and Collaboration between science education ideology, and systematically parses the existing problems in course teaching regarding content update, practical links, and faculty development. By constructing a reform system of "School-enterprise collaboration, Integration of competitions and research, Multidimensional evaluation", specific paths such as Modular reconstruction of course content, Hierarchical construction of practice platforms, and Dual - ability cultivation of teaching staff are proposed. It aims to enhance students' Engineering practice ability and Innovative thinking, and provide a reference implementation plan for Integration of industry and education in Traffic courses.***

Keywords: Traffic Management and Control; Industry-education integration; The OBE concept;Practical teaching reform; Collaborative education

I. INTRODUCTION

In the context of accelerated urbanization and the development of new engineering disciplines, the application of new technologies such as intelligent transportation and vehicle-road coordination has made traffic management scenarios increasingly complex, and the industry has put forward higher requirements for the practical ability and innovative quality of talents. Traffic Control and Management, as a core course for traffic engineering, combines theoretical systematicness with practical operability, but there are still three major pain points in its traditional teaching mode: First, the course content lags behind the technological iteration of the industry, and there is a lack of cutting-edge content such as intelligent signal control and big data traffic analysis; Second, practical teaching is confined to laboratory simulations and lacks engineering experience in real scenarios; Third, the teaching staff "emphasizes theory over practice" and has insufficient industry experience reserves.

Industry-education integration, as a key link connecting the education chain and the industrial chain, has become the core direction of engineering education reform. Based on the OBE's core idea of "outcome-oriented and continuous improvement" , and in combination with the concept of collaborative education through science and technology, this paper explores the teaching reform path of "deep participation of enterprises, projects throughout the process, and precise matching of capabilities" , aiming to achieve seamless connection between curriculum teaching and industry demands.

II. ANALYSIS OF THE CORE ISSUES OF INDUSTRY-EDUCATION INTEGRATION REFORM

A. Mismatch between curriculum content and industry demand

The traditional course content is mainly based on classic transportation theory, focusing on static traffic management and basic control methods.

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It covers insufficiently the actual needs of dynamic control under intelligent connected environment and coordinated optimization of regional transportation . The teaching material update cycle is long, and it is difficult to include the operational technology of signal control system upgrade and traffic big data analysis that enterprises are currently using. As a result, there is a disconnection between students' knowledge system and job requirements.

B. Insufficient Support For Practical Teaching Links

The current practices rely heavily on simulation software and lack realistic traffic scenarios for practical training. The construction of practice bases both inside and outside the school is merely formal, with low involvement from enterprises, making it difficult to offer opportunities for practical training such as signal debugging and traffic congestion management. At the same time, there is insufficient connection between practice teaching and research projects and disciplinary competitions, and students' abilities to solve actual engineering problems are not effectively exercised.

C. Dual-Teacher Type Faculty Construction Lagging

Most teachers are research-oriented talents graduated from universities, who lack practical experience in traffic management departments or enterprises. As a result, it is difficult for them to integrate industry front-line cases and engineering experience into teaching. The existing assessment system focuses on research achievements, which makes teachers have little motivation to participate in enterprise practice. This leads to a vicious circle where “they cannot teach practical skills, and students cannot meet the actual needs after training”.

D. The Collaborative Education Mechanism Is Not Yet Sound

School-enterprise cooperation often stays at the surface level, such as enterprise visits and expert lectures. There is a lack of long-term cooperation mechanisms with clear responsibilities. Enterprises have insufficient say in curriculum design and standard setting, leading to misalignment between talent cultivation quality and enterprise position requirements. There is a lack of synergy between industry and education in talent cultivation.

III. IMPLEMENTATION PATH OF INTEGRATION OF INDUSTRY AND EDUCATION

A. Course content module reconstruction: align with industry job capabilities

Based on the job requirements of enterprises, a three-dimensional content system of "basic theory + industry module + frontiers topic" is constructed.

The basic theory module will be streamlined and consolidated to highlight core knowledge points, providing a solid theoretical foundation for students. except some outdated or repetitive contents . for example , the teaching units can be designed around the core contents such as traffic flow theory and the basic principles of signal control , so that the most critical knowledge can be grasped by students within the limited learning time . besides , in view of the OBE concept , the optimized basic theory module should pay more attention to the goal orientation of learning outcomes , that is , to clarify the specific supporting roles of each part for the students future professional capabilities , so as to enhance the targeting and effectiveness of teaching .

Introduction of industry modules: not only can it help students understand the latest developments in the industry, but also stimulate their learning interest and innovative thinking. For example, case study teaching method can be adopted to integrate the technical application experience in actual projects into classroom teaching. Furthermore, involving business experts in course design can help develop relevant teaching resources that are both practical and forward-looking. This way, students can be exposed to real industry demands during their studies, providing them with strong support for their future career development. Frontier Topic Module: Inviting enterprise technical experts to lecture on new technologies such as vehicle-road coordinated management and autonomous driving traffic organization, and transforming enterprise research projects into teaching topics.

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B. Practical platform hierarchical construction: achieving transition from simulation to combat

Based on the "experiment - base - competition - research" progressive practice concept, a four-level practice platform system is constructed: The basic experiment layer: traffic flow simulation and simple signal timing training are carried out base on the school's laboratory, lay a solid foundation for operational ability.

At the enterprise practice level, students will work with traffic technology companies and traffic management departments to set up practice bases. They will participate in auxiliary work for real projects such as traffic signal setting at intersections and traffic flow surveys and analysis.

Competition enhancement layer: Based on the "Internet + Transportation" and "Smart Transportation Innovation Competition" carriers, enterprise practical problems are transformed into competition questions to promote the integration of competition and teaching.

Research innovation layer: Encourage students to participate in research projects collaboratively conducted by teachers and enterprises, such as optimizing traffic control plans and testing smart devices, to achieve reverse innovation from research to teaching.

C. Dual competence cultivation of faculty team: Building a school-enterprise communication mechanism

A "school teacher + enterprise mentor" dual-teacher team is established, and three measures are taken to strengthen teacher capabilities:

In-house teacher "empowerment through practice": Implement the enterprise internship program for teachers, requiring professional teachers to participate in project practice for no less than 1 month per year in cooperating enterprises, and transform industry experience into teaching content.

Enterprise mentor "teaching empowerment": Hire enterprise technical backbone as part-time teachers to conduct case teaching and practical guidance. Formulate the "enterprise mentor teaching regulations" to clarify responsibilities and authorities.

The dual-incentive assessment mechanism: Incorporate enterprise practice experience and school-enterprise cooperation projects into the teacher assessment indicators, provide teaching subsidy and honorary recognition for enterprise mentors, and stimulate the enthusiasm of both parties to participate.

D. Diversification of assessment system: focus on competency achievement

Based on the OBE concept, a three-dimensional assessment system of "process + outcome + enterprise" was constructed: in terms of assessment subjects, enterprise experts, teachers, student self-assessment and peer assessment were introduced to participate in course evaluation. Through the participation of multiple subjects, the assessment results will be more comprehensive and objective, thus providing students with more targeted improvement recommendations.

Process assessment (40%): covers in-class case studies, practice reports, and project phase results, focusing on continuous improvement in the learning process.

Achievement-based assessment (30%): Using real projects from enterprises, the assessment focuses on students' ability to design control strategies and solve problems, such as the feasibility evaluation of a regional traffic signal coordination optimization scheme.

Enterprise Assessment (30%): Evaluated by enterprise mentors based on student performance and job fit, ensuring alignment with industry standards.

IV. THE EXPECTED EFFECT ANALYSIS OF THE REFORM PATH

Firstly, in terms of engineering practice capabilities, by participating in actual projects and realistic scenarios of enterprises, students will master the application methods of front-end technologies such as intelligent signal control and big data traffic analysis, so as to better adapt to the needs of future work.

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Secondly, the cultivation of innovative thinking will also be one of the important results of the reform. The integration of scientific research into teaching and the competition-driven teaching model can inspire students' spirit of exploration, guide them to actively participate in scientific research projects and competitive activities, and improve their ability to solve complex problems. Besides, the enhancement of team collaboration skills is also indispensable. In summary, the implementation of the reform path is expected to comprehensively improve students' engineering practice ability, innovative thinking, and team collaboration skills.

V. CONCLUSIONS

The reform of the "Traffic Control and Management" course focuses on breaking down the barriers between "school teaching and enterprise application", and building a new teaching ecology oriented towards demand, driven by projects, and jointly cultivated by industry and education. By aligning course content with industry needs, integrating practice platforms to connect school and enterprise resources, strengthening the dual capabilities of teachers, and focusing on capability achievement in the evaluation system, the quality of talent cultivation has been effectively improved.The reform path can provide a reference for the integration of industry and education in similar courses, and help to cultivate application-oriented innovative talents adapted to the development of intelligent transportation.

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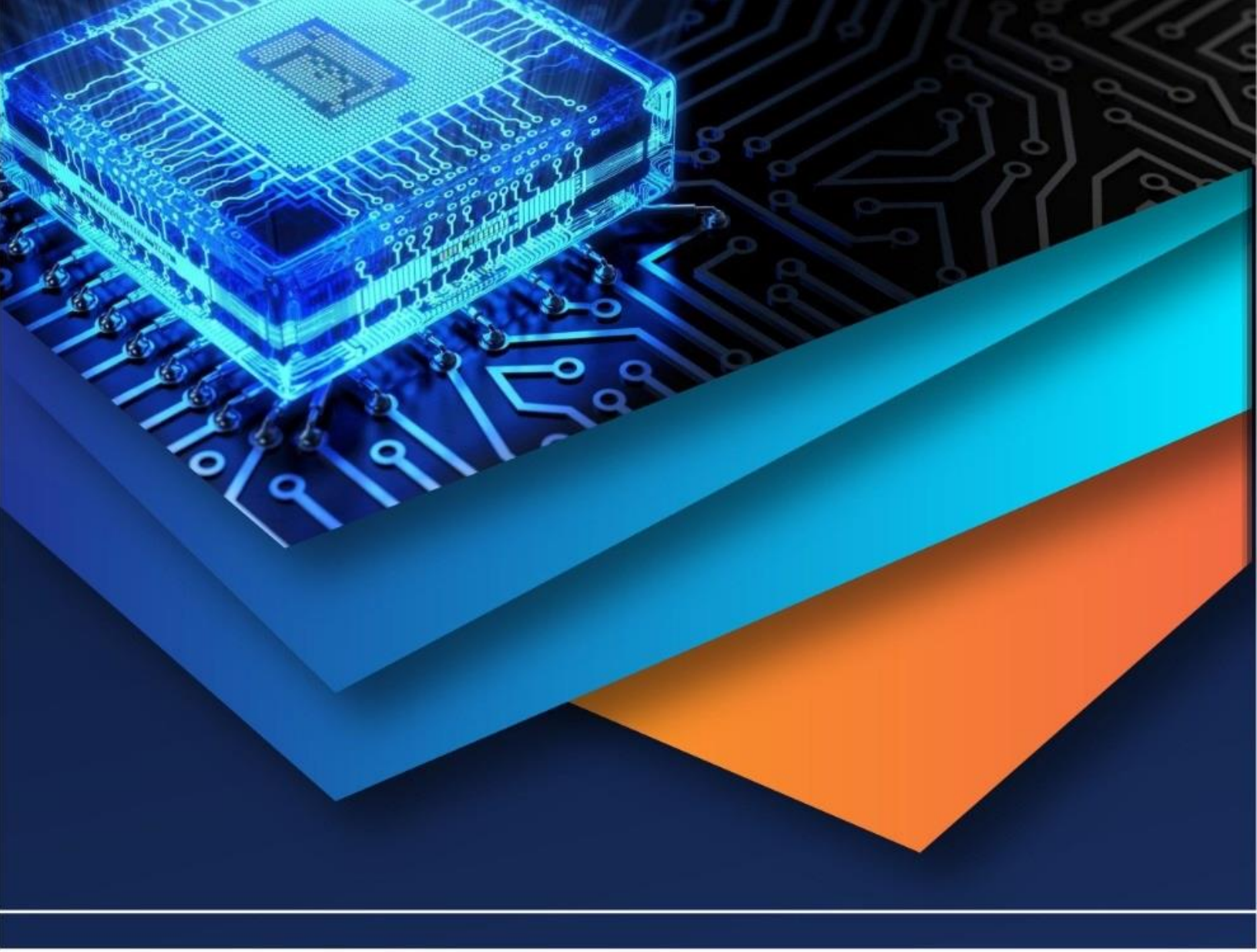

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