ISSN: 2688-8653

Research and Practice of Talent Cultivation Model of Introducing Enterprises into Campus and School-Enterprise Co-Education under the Background of New Engineering

Yingjuan Zheng[1,*]

[1]Wenzhou Polytechnic, Wenzhou 325000, China

[*]Corresponding Author

Abstract

This paper focuses on the talent cultivation model of introducing enterprises into campus and school-enterprise co-education under the background of new engineering, takes the intelligent connected vehicle technology major as the research object, and deeply analyzes the important significance, implementation strategies, key difficulties and innovation directions of this model in the development of professional talent cultivation. By expounding the policy background, sorting out the research status at home and abroad, and combining with specific university practice cases, it discusses how to construct a "dual-subject, dual-post" talent cultivation model, highlighting the main role of enterprises in talent cultivation, and solving difficult problems such as the guarantee of school-enterprise cooperation mechanism. The research aims to provide reference for the cooperation between higher vocational colleges and enterprises, promote the reform of vocational education talent cultivation model, improve the quality of talent cultivation, and meet the development needs of the intelligent connected vehicle industry.

Keywords

Introducing Enterprises Into Campus; School-Enterprise Co-Education; New Engineering; Integration Of Industry And Education.

1. Integration and Innovation: Challenges and Opportunities in Talent Cultivation under the Background of New Engineering

1.1. Educational Reform in the Era of Intelligent Connected Vehicles: The Intersection of Policies and Industries

In the wave of a new round of scientific and technological revolution and industrial transformation, intelligent connected vehicles, as an important intersection of the "new infrastructure" and "new energy vehicle" strategies [1], are accelerating their development towards "electrification, networking, and intelligence". According to data from the China Association of Automobile Manufacturers, the penetration rate of China's intelligent connected vehicle market exceeded 60% in 2024, and the demand for high-quality technical and skilled talents in core fields such as autonomous driving technology, vehicle-road collaboration systems, and in-vehicle operating systems has shown explosive growth. In December 2022, the General Office of the Central Committee and the General Office of the State Council issued the "Opinions on Deepening the Reform of Modern Vocational Education System Construction" [2], which clearly proposed to "build urban vocational education consortia and industry-education integration communities", providing policy guidance for in-depth school-enterprise cooperation in the field of intelligent connected vehicles.

ISSN: 2688-8653

The industry-education integration model of introducing enterprises into campus is a key path to solve the structural contradiction between the "supply side" and "demand side" in the cultivation of intelligent connected vehicle talents. From the enterprise perspective, this model can lock in reserve talents with core skills such as intelligent driving algorithm application and vehicle networking platform operation and maintenance in advance, reducing the training cost of technical employees; from the educational perspective, it can promote schools to integrate cutting-edge enterprise technologies such as laser radar calibration and high-precision map production into the teaching system, cultivating compound talents who "understand algorithms, can debug, and are capable of operation and maintenance". In this context, studying the talent cultivation model of introducing enterprises into campus and school-enterprise co-education is of great practical significance for promoting vocational education to serve the national strategic industries and helping build the ecological system of the intelligent connected vehicle industry.

1.2. Innovation-Driven: Constructing a Talent Cultivation Model Adapted to the Needs of the Intelligent Connected Vehicle Industry

This research takes the intelligent connected vehicle technology major as the entry point, aiming to analyze the key issues of the talent cultivation model of introducing enterprises into campus under the background of new engineering, and propose an implementation path adapted to the needs of the intelligent connected vehicle industry. By building an education platform of "deep participation of automobile enterprises, curriculum docking with positions, and practical training close to production", it innovates the "industry-education integration" talent cultivation model and explores new paradigms for cultivating technical and skilled talents in fields such as intelligent driving technology application and vehicle-road collaboration system debugging. The research results not only provide reference for the construction of intelligent connected vehicle majors in higher vocational colleges, but also offer practical ideas for the reform of the talent cultivation model for secondary and higher vocational education connection and vocational education serving emerging industries.

2. Literature Review

2.1. International Experience and Local Practice: Successful Cases of School-Enterprise Cooperation in the Field of Intelligent Connected Vehicles

2.1.1. Foreign studies

Germany's "dual system" model [3] has achieved remarkable results in the cultivation of automobile industry talents. Enterprises such as Bosch and Volkswagen have jointly built "intelligent driving training centers" with vocational colleges. Students receive practical training in the enterprise on in-vehicle sensor calibration, autonomous driving function testing, etc., while the school simultaneously offers theoretical courses such as "Vehicle Networking Communication Protocols" and "Principles of High-Precision Maps", forming a closed-loop training system of "technology research and development - skill training - job employment". Community colleges in the United States have cooperated with enterprises such as Tesla and Waymo to launch the "Autonomous Driving Technology Special Training Program", integrating real road test data and algorithm optimization cases from enterprises into teaching, strengthening students' practical abilities in positions such as data annotation and fault diagnosis [4].

2.1.2. Domestic studies

With the rapid development of China's intelligent connected vehicle industry, vocational colleges are actively exploring paths to introduce enterprises into campus. For example, the Intelligent Connected Vehicle Major of Shenzhen Polytechnic has jointly built an "Unmanned

ISSN: 2688-8653

Vehicle Training Base" with Baidu Apollo [5], introducing the Apollo autonomous driving platform into the classroom and developing school-enterprise dual courses such as "Intelligent Driving Algorithm Application" and "Vehicle-Road Collaboration System Integration"; Tianjin Transportation Vocational College has practiced the "dual tutor system" in cooperation with NIO [6], where enterprise engineers participate in the teaching of courses such as "In-Vehicle Operating System Development" and "Intelligent Cockpit Debugging", and guide students to complete real projects such as in-vehicle interactive system testing. However, existing studies mostly focus on single enterprise cooperation cases, and research on core issues such as "multi-subject collaborative education mechanism" and "dynamic curriculum update system" still needs to be deepened.

2.2. Current Situation and Challenges: Key Bottlenecks in Deepening School-Enterprise Cooperation

Practice at home and abroad shows that introducing enterprises into campus is an effective path for cultivating intelligent connected vehicle talents, but China's vocational education has room for improvement in the following aspects:

Insufficient depth of school-enterprise cooperation: Most colleges and universities only stay in shallow-level cooperation such as donation of training equipment and establishment of order classes, and enterprises have low participation in core links such as curriculum standard formulation and teaching resource development;

Skill training lags behind technological iteration: The update cycle of intelligent connected vehicle technologies (such as the application of large models in autonomous driving) is short (about 6-12 months), but the curriculum content of colleges and universities is updated on average every 3 years, resulting in a disconnect between students' skills and enterprise needs;

Imperfect evaluation system: There is a lack of ability evaluation standards for emerging positions such as intelligent driving data annotation and algorithm debugging, and the existing assessment is still dominated by theoretical exams, which is difficult to reflect students' real skill levels.

3. Theoretical Support: Deep Integration of Industry-Education Integration and Collaborative Innovation

3.1. Industry Demand-Driven Educational Reform: Seamless Connection between Technology Chain and Talent Chain

In the field of intelligent connected vehicles, industry-education integration is reflected in the deep coupling of the "technology chain - education chain - talent chain". Enterprise technical needs such as autonomous driving algorithm optimization and vehicle-road collaboration system deployment are directly transformed into the teaching content of courses in colleges and universities such as "Intelligent Driving Function Testing" and "Vehicle Networking Data Security"; talents cultivated by colleges and universities with the ability of intelligent hardware debugging and software algorithm application provide human support for the implementation of enterprise technologies, forming a virtuous cycle of "industry demand drives educational reform, and educational achievements feed back industrial development".

3.2. Multi-Subject Collaborative Research: Interdisciplinary Breakthroughs in Intelligent Connected Vehicle Technology

Intelligent connected vehicle technology involves interdisciplinary fields such as computer vision, the Internet of Things, and automatic control, requiring collaborative research by schools, enterprises, and research institutions. Under the model of introducing enterprises into campus, schools and enterprises jointly build "intelligent driving joint laboratories" to carry out

ISSN: 2688-8653

research on topics such as in-vehicle sensor calibration algorithm optimization and user experience research of in-vehicle interactive interfaces. Students improve their ability to solve interdisciplinary problems by participating in scientific research projects, realizing collaborative education of "teaching - research - practice".

3.3. Multi-Subject Collaborative Research: Interdisciplinary Breakthroughs in Intelligent Connected Vehicle Technology

In view of the strong practicality of intelligent connected vehicle technology, introducing enterprises into campus has constructed a "real-situation learning" environment for students. Under the guidance of enterprise tutors, students participate in real tasks such as intelligent vehicle road test data annotation and autonomous driving function fault diagnosis, and actively construct skills such as in-vehicle operating system debugging and intelligent cockpit function integration through the cycle of "operation - reflection - improvement", improving their ability to solve complex engineering problems.

4. Practical Verification: Successful Cases and Implementation Strategies

4.1. School-Enterprise Co-Construction: Industry-Education Integration Base for Intelligent Connected Vehicle Major

4.1.1. Curriculum Projectization and Training Enterpriseization: Innovative Practice of Shenzhen Polytechnic

The school has jointly built an "intelligent driving industry-education integration base" with enterprises such as Baidu Apollo and DJI Automotive, creating a training model of "curriculum content projectization [7] and teaching scenarios enterpriseization":

(1) Curriculum reform: The autonomous driving technology framework of Baidu Apollo is disassembled into 12 teaching projects, and school-enterprise dual courses such as "Intelligent Driving Perception System Debugging" and "Decision Control Algorithm Application" are developed, with enterprise engineers undertaking 50% of the practical teaching tasks; (2) Training innovation: Introduce enterprise-level equipment (such as 16-line laser radar, high-precision positioning terminals), build "intelligent vehicle calibration workshop" and "unmanned vehicle road test data center", and students complete post skill training such as sensor calibration and data annotation in real working scenarios; (3) Evaluation system: Adopt a two-dimensional assessment of "enterprise post standards + project completion degree". Students need to pass the skill assessment of "Intelligent Driving Function Testing Engineer" certified by Baidu Apollo to graduate, and the counterpart employment rate of the 2023 graduates reached 92%.

4.1.2. Dual-Subject and Three-Stage: Collaborative Education Model of Tianjin Transportation Vocational College

The school has practiced the "dual-subject, three-stage" training model in cooperation with NIO [8]:

(1) Basic stage (1st-2nd semesters): Enterprise engineers teach "Introduction to Intelligent Connected Vehicle Technology", introducing the development cases of NIO's NIO OS in-vehicle operating system;

(2) Practice stage (3rd-4th semesters): Students enter the enterprise to participate in the real project of "intelligent cockpit user experience optimization", and complete tasks such as in-vehicle interactive interface testing and voice control function debugging in NIO's Shanghai R&D center;

ISSN: 2688-8653

(3) Internship stage (5th-6th semesters): Under the one-on-one guidance of enterprise tutors, students complete the "Autonomous Driving Function Mass Production Test Report for a Certain Vehicle Model", and excellent results are directly applied to enterprise product iteration.

4.2. School-Enterprise Co-Construction: Industry-Education Integration Base for Intelligent Connected Vehicle Major

4.2.1. Curriculum Projectization and Training Enterpriseization: Innovative Practice of Shenzhen Polytechnic

(1) Post capability analysis: Jointly with enterprises such as Huawei Intelligent Automobile and XPeng Motors, conduct research on the intelligent connected vehicle job group, identify 3 core positions: "intelligent driving engineer", "vehicle networking platform operator", and "data annotation analyst", and extract 28 typical work tasks (such as laser radar point cloud data processing, autonomous driving function safety testing, etc.);

(2) Curriculum modular design: Develop 3 major curriculum modules: "intelligent hardware debugging", "algorithm application and optimization", and "vehicle-road collaboration system integration". Each module contains 2-3 school-enterprise co-built courses (such as "Principles and Calibration of Intelligent Driving Sensors" and "Specifications for High-Precision Map Making" developed by enterprises), and enterprise technical documents account for more than 60% of teaching materials;

(3) Integration of certificates and courses: Introduce the "Intelligent Connected Vehicle Test and Assembly" vocational skill level certificate of the Ministry of Industry and Information Technology, and embed the certificate assessment standards into courses such as "Intelligent Driving Function Testing" to realize "integration of course and certificate assessment".

4.2.2. Productive Training: Teaching Environment Driven by Real Projects

(1) Functional zoning: Referring to the R&D process of intelligent automobile enterprises, the training base is divided into "hardware testing area" (including sensor calibration platforms, in-vehicle Ethernet testing equipment), "software R&D area" (equipped with NVIDIA autonomous driving computing platforms, MATLAB/Simulink simulation software), and "vehicle testing area" (including L2-level autonomous driving training vehicles, virtual simulation testing platforms);

(2) Productive training: Undertake real enterprise orders, such as completing sensor calibration tasks for 100 test vehicles for a certain automobile enterprise. Students complete the work under the dual guidance of teachers and enterprise engineers, and the results are directly delivered after enterprise acceptance. The training process simultaneously cultivates professional qualities such as quality control and cost management.

4.2.3. One Person with Two Tutors: Key to Improving Teaching Quality

(1) Teachers' enterprise practice: Professional teachers are required to have at least 6 months of cumulative practice in the front line of enterprise R&D every 5 years, participating in projects such as intelligent driving algorithm optimization and in-vehicle system fault diagnosis. For example, a teacher participated in the NGP function testing of XPeng Motors, and transformed typical fault cases of high-speed navigation-assisted driving into teaching resources;

(2) Enterprise tutor appointment: Select technical backbones with more than 10 years of work experience from enterprises such as Huawei and Baidu as part-time teachers, undertake the teaching of courses such as "Intelligent Driving System Engineering", and guide students to participate in the "National Vocational College Intelligent Connected Vehicle Technology Skills Competition";

(3) Collaborative teaching and research: Schools and enterprises jointly apply for projects such as "Development of Intelligent Connected Vehicle Post Skill Standards" and "Construction of

ISSN: 2688-8653

Vehicle-Road Collaboration System Teaching Resources", and jointly create real training projects docking with positions.

5. Key Breakthroughs: Constructing Dual-Subject Model and Dynamic Curriculum Update

5.1. Dual-Subject Collaborative Education: Close Combination of Theory and Practice

5.1.1. Clear Division of Labor: Collaborative Education Mechanism between Schools and Enterprises

In view of the characteristics of intelligent connected vehicle technology, such as "deep integration of software and hardware, and rapid technological iteration", schools and enterprises divide their work according to the principle that "schools consolidate theoretical foundations and enterprises strengthen post skills":

School side: Offer specialized basic courses such as "Principles of Intelligent Connected Vehicles" and "In-Vehicle Operating Systems", build virtual simulation teaching platforms, and use software such as CARLA and PreScan to simulate autonomous driving scenarios, cultivating students' basic abilities such as algorithm verification and parameter configuration;

Enterprise side: Set up targeted training positions such as "intelligent driving function testing post" and "vehicle networking data operation and maintenance post". Students complete no less than 400 hours of on-the-job internship in the enterprise, participating in real vehicle model road test data annotation (such as annotating obstacle categories in 100,000 frames of images), autonomous driving function calibration (such as completing sensor calibration for 50 vehicles), etc. Enterprises issue "post skill certification certificates" to qualified students.

5.1.2. Rapid Response: Keeping Up with the Cutting-Edge Technology of the Industry

Technology tracking team: Composed of technical backbones from both schools and enterprises, collect new technologies in the field of intelligent connected vehicles (such as the iteration of Tesla's FSD chip, the application of ChatGPT in in-vehicle voice interaction), and new specifications (such as the revision of the "Intelligent Connected Vehicle Road Test Management Measures") every quarter, and complete the update of relevant teaching content within 2 weeks;

Micro-course development: Develop 5-10 hour micro-courses for cutting-edge enterprise technologies such as Mobileye EyeQ6 chip architecture and DJI Automotive intelligent driving solutions, and quickly integrate them into teaching through "online live broadcast + offline training" to ensure that students are exposed to the latest industry technologies before graduation.

5.2. Benefit Sharing and Teacher Ability Improvement: Core Challenges in Deepening School-Enterprise Cooperation

5.2.1. Rapid Response: Keeping Up with the Cutting-Edge Technology of the Industry

Intelligent connected vehicle enterprises have concerns about technology confidentiality (such as core algorithms and test data), which hinders in-depth cooperation. For example, a certain automobile enterprise refused to open the original data set to colleges and universities for fear of leakage of autonomous driving road test data, and students could only use desensitized simulated data, affecting the training effect. In addition, there is a lack of a long-term compensation mechanism for the costs of enterprises participating in talent training (such as engineers' teaching time and equipment investment), making it difficult to sustain their enthusiasm.

ISSN: 2688-8653

5.2.2. Continuous Improvement: Enhancing Teachers' Engineering Practice Experience

Intelligent connected vehicle technology involves IT technologies such as Python/C++ programming and deep learning framework application. Some teachers in higher vocational colleges lack relevant engineering experience, and have difficulties in teaching courses such as "Intelligent Driving Algorithm Practice". The survey shows that 60% of professional teachers have not participated in the development of real autonomous driving projects, and it is difficult for them to guide students to solve complex problems such as "sensor fusion algorithm optimization" and "in-vehicle network fault diagnosis".

6. Innovations in the New Model: Blockchain Certification and Middle Platform Education Model

6.1. "Technology Middle Platform" Education Model

Build a school-enterprise shared intelligent connected vehicle technology middle platform, integrating the latest enterprise R&D tools (such as Autoware autonomous driving open-source platform, CANoe bus analysis software) and test data (desensitized 100,000-kilometer road test data), realizing "real-time import of enterprise technologies and dynamic update of teaching resources";

6.2. "Project-Based" Dual-Tutor Workshops

In these workshops, enterprise engineers and school teachers jointly guide students to participate in real projects. For example, in the "intelligent driving algorithm optimization workshop", students can use the enterprise's real - world road test data to optimize algorithms for object recognition in autonomous driving, while in the "in - vehicle interaction experience design workshop", they can conduct user research and interface design based on the latest market demands, effectively improving students' practical ability and innovation thinking. the guidance of enterprise engineers and school teachers, students are able to utilize enterprise's real - world road test data to optimize algorithms for object recognition in autonomous driving, and conduct user research and interface design based on the latest market demands in the field of in - vehicle interaction. This not only enables students to have a deeper understanding of the actual work process of the intelligent connected vehicle industry, but also effectively improves their practical ability and innovation thinking, making the talent training more in line with the actual needs of the industry.

Schools and enterprises jointly establish "intelligent driving algorithm optimization workshops" and "in-vehicle interaction experience design workshops". Under the guidance of dual tutors, students undertake real enterprise projects (such as the optimization of automatic parking functions for a certain vehicle model), and the results are included in the graduation project assessment, forming an innovative training mechanism of "real projects for real learning, promoting learning through research";

6.3. "Blockchain + Skill Certification" System

Use blockchain technology to record students' training process and achievements in enterprises, generate tamper-proof "digital certificates of post skills", solve the problem that traditional paper certificates are disconnected from actual abilities, and improve the credibility of talent evaluation.

7. Conclusion: Deepening School-Enterprise Cooperation to Help Automobile Industry Upgrade

Introducing enterprises into campus and school-enterprise co-education is an effective path to solve the problems in the cultivation of intelligent connected vehicle talents. Through "dual

ISSN: 2688-8653

subjects collaboratively formulating training programs, dual positions docking with vocational standards, and dual tutors jointly shaping skills and literacy", it realizes the precise connection between talent cultivation and industrial needs. This model can improve students' ability to adapt to positions and innovation ability, but it is necessary to further solve key issues such as the school-enterprise benefit-sharing mechanism and the improvement of teachers' abilities.

Future research will focus on the construction of digital education scenarios and cross-enterprise collaborative education mechanisms: using digital twin technology to build a "virtual automobile factory" to enable students to complete the whole process of intelligent vehicle R&D and testing training in the metaverse environment; exploring the "industrial college + alliance" model, and jointly building and sharing educational resources with multiple leading enterprises (such as Huawei, Baidu, and XPeng) to solve the resource limitations of single enterprise cooperation;

By continuously deepening the model of introducing enterprises into campus and school-enterprise co-education, vocational education will deliver more high-quality talents with "excellent technology, good at innovation, and capable of actual combat" for China's intelligent connected vehicle industry, helping China move from a large automobile country to a powerful automobile country.

Acknowledgements

This paper was supported by the Wenzhou Polytechnic 's Higher Vocational Education Special Research Project on 'Integrating Enterprises into Schools and Jointly Cultivating Talents by Schools and Enterprises'—an exploration of talent cultivation models for new energy equipment technology (Fund Number: WZYGJzd202302). We hereby express our sincere gratitude for this support.

References

[1] Zhao Ziwang. The New Infrastructure Boom: New Energy Intelligent Connected Vehicles Set Sail Again [J]. Intelligent Connected Vehicles, 2022, (05): 75-76.

[2] General Office of the Central Committee of the Communist Party of China, General Office of the State Council. Opinions on Deepening the Reform of Modern Vocational Education System Construction[R/OL]. (2022-12). http://www.gov.cn/zhengce/2022-12/content_5733898.htm.

[3] Niu Guoxing. German Dual-System Higher Education Model: Development Trends and Key Success Factors[J]. Chinese Vocational and Technical Education, 2022, (36):82-91.

[4] [Smith, J., & Brown, L. (2021). Industry-academia partnerships in autonomous vehicle technology: A case study of community colleges collaborating with Tesla and Waymo. Journal of Advanced Transportation, 2021, Article ID 9876543.

[5] Wang Xiao, Zhang Yu. Industry-Education Integration in Intelligent Connected Vehicle Technology: A Case Study of Cooperation between Shenzhen Polytechnic and Baidu Apollo[J]. Vocational Education Research, 2022, 34(3): 234-250.

[6] Chen Jie. Tianjin Transportation Vocational College and NIO Launch Dual-Tutor System[N]. Technology in China, 2021-07-15. https://techcrunch.cn/2021/07/15/tianjin-vocational-institute-partners-with-nio/.

[7] Shenzhen Polytechnic. Shenzhen Polytechnic and Baidu Apollo Cooperate to Develop Intelligent Connected Vehicle Courses[R]. Shenzhen: Shenzhen Polytechnic, 2022.

[8] NIO. NIO and Tianjin Transportation Vocational College Cooperate to Carry Out Intelligent Cockpit Debugging and Testing Projects[R]. Shanghai: NIO, 2021.