Exploration and Practice of the Training Model for Automotive Applied Talents Guided by Modern Engineering Ability

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Abstract: The global automotive industry is accelerating its rapid development towards electrification, intelligence, and software defined cars. Therefore, it is particularly important to cultivate automotive application talents with modern engineering capabilities. This article is based on the V-shaped development process of automobiles, and systematically explores the modern engineering ability-oriented training mode for applied talents in the automotive industry. By optimizing the curriculum system, strengthening practical links, and collaborating with schools and enterprises, we can effectively enhance students' modern engineering abilities and comprehensive qualities. The exploration and practice of the past three years of students have achieved significant results, and their modern engineering abilities and comprehensive qualities have significantly improved. The employment rate and professional matching rate of graduates have been increasing year by year. These achievements fully demonstrate that the optimized training mode is effective and can provide high-quality talent support for the development of the automotive industry.

Keywords: Modern Engineering Capabilities; Engineering Tools; Practical Personnel; Training Mode

1. Introduction

With the global automotive industry moving towards electrification, intelligence, networking, and sharing, especially influenced by the concept of software defined cars, modern engineering capabilities have become the core quality of automotive professionals. The automotive industry requires excellent engineers who master modern engineering design theories, methods, and tools. In foreign countries, the quality of talent cultivation in engineering education is mainly ensured through the engineering education professional certification system, while domestic scholars have made some explorations in the cultivation of applied talents based on the Chinese engineering education professional certification system [1,2]. However, how to adapt the cultivation of applied talents to modern engineering applications, especially to improve the modern engineering capabilities of automotive applied talents, is still an urgent problem to be solved [3,4]. At present, automotive applied talents with modern engineering capabilities and the ability to take up positions upon graduation and apply them immediately are far from meeting market demand in terms of quantity and quality, which will pose a huge obstacle to industrial development [5,6]. In order to meet this demand, this article focuses on exploring reforms and explorations in the curriculum system, faculty building, and school enterprise cooperation.

2. Modern Engineering Tools Essential for Automotive Applied Talents

By conducting research and analysis on the modern engineering tools used by automotive enterprises, and combining with the usage of modern engineering tools in various stages of automotive V-shaped development, the modern engineering tools required for the cultivation of applied talents in various stages of automotive design have been compiled. These tools are crucial for efficient, accurate, and reliable automotive design and engineering development. In order to enable students to proficiently master these essential modern engineering tools, the management and engineers of the research enterprise not only recommended the software names required for each stage, but also recommended corresponding theoretical and

practical courses, as shown in Table 1. These courses aim to cultivate talents with the ability to use modern engineering tools, thereby further promoting the progress of automotive design and engineering development.

Table 1. Application of Modern Engineering Tools in the Development Process of Automobile V-shaped

Order Number	Development Process	Engineering Tool Type	Modern Engineering Tool	Recommendation Theory Course	Recommendation Practice Course
1	Requirements Analysis Phase	Document Writing Tools	Microsoft Word, Google Docs	Requirements analysis theory, project management foundation, etc.	Practice in requirement analysis, document writing, etc.
2	System Design Phase	CAD Modeling Software	SolidWorks, CATIA, UG etc.	System design theory, modeling technology, CAD principles and applications, etc.	System design practice, modeling technology practice, CAD application practice, etc.
3	Software Design Phase	CAD Modeling Software and Circuit Design Software	SolidWorks, CATIA, UG etc. Altium Designer, Eagle etc.	Software design theory, modeling technology, CAD principles and applications, etc. Circuit design principles and applications, etc.	Software design practice, modeling technology practice, CAD application practice; Circuit design practice, etc.
4	Test Plan Phase	Test Management Tools, Data Statistics Tools	TestRail, Jira etc. Microsoft Excel, Tableau etc.	Software testing theory and testing management theory, Data analysis theory, etc.	Software testing practice and testing management practice, Data analysis practice, etc.
5	Design and Development Phase (Software Development)	IDE (Integrated Development Environment), Version Control Tools, Debugging Tools, Testing Tools	Visual Studio Code, Eclipse etc. Git, SVN etc. Debugging Tools, JUnit, pytest etc.	Software engineering theory, programming language principles, algorithms and data structures, etc. Version control principles, etc. Debugging and testing principles and applications, etc.	Software engineering practice, programming language practice, algorithm and data structure practice, Version control practices, Debugging and testing practices, etc.
6	Design and Development Phase (Hardware Development)	IDE (Integrated Development Environment), Version Control Tools, Debugging Tools, Circuit Design Software, etc.	Visual Studio Code, Eclipse etc. Git, SVN etc. Debugging Tools, Eagle, KiCad etc.	Hardware design principles, circuit design principles, and applications, Version control principles, etc. Principles and applications of debugging and testing, Application of circuit design software, etc.	Hardware design practice and circuit design practice, Version control practices, Debugging and testing practices, Practical application of circuit design software, etc.

7	Verification and Acceptance Phase	Quality management software and tools	QlikView, Microsoft Access, TestRail, Jira	The theoretical basis and methods of quality management system certification, as well as the foundation of data analysis.	The use of quality management systems, data analysis and interpretation

3. Practice of Modern Engineering Capability Oriented Training Model for Automotive Applied Talents

3.1 Optimizing the Course System

A comprehensive discussion and revision of the talent training model has been conducted based on the latest industry trends and talent needs, as well as the training objectives and graduation requirements of this major. The carefully designed training plan and curriculum system emphasize the organic combination of theory and practice, with a greater emphasis on the application of modern engineering tools. Integrate these essential modern engineering tools organically into theoretical and practical courses, while increasing the credits for practical courses from 30% to 35%, as shown in Table 2. This optimized curriculum system aims to systematically cultivate high-quality talents that meet the needs of modern automotive enterprises.

Table 2. Comparison between the Optimized Curriculum System and the Original Curriculum System

Name	Development Process	Before Optimization			After Optimization		
		Course Name	Modern Engineering Tool	Course Type	Course Name	Modern Engineering Tool	Course Type
Development of Vehicle "V-shaped"	Requirements Analysis Phase	Fundamentals of College Computer Science	Office	Theory	① Engineering Project Management,② Enterprise Engineering Practice,③ Professional Social Practice	Office, Questionnaire survey and analysis	Theory + Practice
	System Design Phase	Engineering Drawing	AutoCAD	Theory	① Computer-aided drawing,② Automotive CAD/CAE,③ Enterprise Engineering Practice,④ Professional Social Practice	①AutoCAD,② CATIA	Theory + Practice
	Software Design Phase	C Language Programming	C Language	Theory	① Automotive Circuit CAD,② New Energy Vehicle Motor Control Technology,③ C Language Programming Practice, ④ Enterprise Engineering Practice,⑤ Professional Social Practice	Altium Designer	Theory + Practice

	Test Plan Phase	×	×		① Comprehensive Training of Programmable Controllers,② Enterprise Engineering Practice,③ Professional Social Practice	①Altium Designer,② Office	Theory + Practice
	Design and Development Phase (Software Development)	C Language Programming	C Language	Theory	① Calculation Methods and Engineering Applications,② Design Practice of Intelligent Vehicle Control,③ Python Programming, ④ Intelligent Vehicle Decision and Control, ⑤ Electric Vehicle Modeling and Simulation Technology,⑥ Virtual Testing and Simulation Technology for Autonomous Driving, ⑦ Enterprise Engineering Practice,⑧ Professional Social Practice	① MATLAB/Simulink,②Python	Theory + Practice
	Design and Development Phase (Hardware Development)	① Fundamentals of Automotive AutoCAD; ② Automotive CAD Technology	① AutoCAD; ②CATIA		① Practice of Circuit Design for New Energy Vehicles,② Innovative Design Comprehensive Training,③ Comprehensive Practical Training of New Energy Vehicles, ④ Intelligent Vehicle Comprehensive Training,⑤ Enterprise Engineering Practice,⑥ Professional Social Practice	①AutoCAD,② CATIA	Theory + Practice
	Verification and Acceptance Phase	×	×		① Engineering Project Management,② Automotive Performance Experiment,③ Enterprise Engineering Practice,④ Professional Social Practice	Project, Access etc.	Theory + Practice

3.2 Strengthening the Construction of Teaching Staff

As an important role in cultivating students, teachers have a decisive impact on cultivating students' modern engineering abilities. By actively introducing teachers with rich practical experience, encouraging them to participate in engineering projects and engaging young teachers in enterprise practice, a series of measures are taken to enhance teachers' modern engineering literacy and practical abilities. After three years of teaching staff construction, the proportion of teachers with practical experience increased from 60% to 100%. Then, teachers combined their research directions and offered theoretical or practical courses on modern engineering tools. At the same time, teachers have also introduced a large number of practical cases from enterprises into the teaching process, greatly enhancing students' interest in learning and skills in using modern engineering tools. After optimization, the teaching staff has been greatly optimized, providing a strong guarantee for student cultivation and helping to promote the development of modern engineering education.

3.3 Deepening School Enterprise Cooperation

School enterprise cooperation is a very effective way to cultivate students' practical abilities. Professional teachers have established close cooperative relationships with multiple enterprises, which provides students with more opportunities to participate in practical engineering projects and apply their theoretical knowledge to practice. In addition, this also provides them with sufficient internship and training bases. After cooperation with enterprises, our teachers have also been given more opportunities to participate in enterprise research and development projects. Professional teachers have jointly established a school level renowned teacher studio, and the funding for project initiation and payment has been increasing year by year. The increase in these funds indicates the recognition and support of the enterprise for our profession. By participating in practical engineering projects in enterprises, students can not only apply their theoretical knowledge to practice, but also improve their ability to use modern engineering tools and teamwork spirit. This cooperation model helps to cultivate applied talents with practical ability and innovative spirit, and lays a solid foundation for students' future career development.

4. Conclusion

After systematic optimization of the training plan and curriculum system for applied talents in the automotive industry, and through continuous exploration and practice by three generations of students, the modern engineering tool usage ability and comprehensive quality of graduates have been significantly improved. This has not only received high praise from the school, but also received high recognition from the enterprise. The optimized talent cultivation model is oriented towards modern engineering abilities and focuses on the cultivation of applied talents in the automotive industry. The implementation of this model has achieved remarkable results, and the employment rate of graduates and professional matching rate have increased year by year. This proves that the optimized talent cultivation model has been significantly improved and is more in line with the actual needs of modern automotive enterprises.

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