

New energy vehicle curriculum reform practice from the perspective of dual system

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Abstract: In 2023, China surpass Japan to become the world's largest auto exporter, and the new energy automobile industry has grown into a pillar industry of the economy. However, there is still inconsistency between the talent training objectives of China's vocational colleges and the business objectives of enterprises. How to train students to master the skills required by enterprises? How to deepen and make the school-enterprise cooperation real? These are the problems that every vocational education person needs to think about. Taking the course of "Automotive Electrical Equipment and Principles" as the breakthrough point, this paper analyses the problems of the current teaching mode, and implements the dual system teaching by building a "dual-subject" education platform of school and enterprise, finally realizing the double improvement of teaching quality and student ability.

Keywords: Dual System, New energy vehicle technology major, Teaching reform, Cooperation between school and enterprise

1. Introduction

As one of the important driving forces for national economic development, the new energy automobile industry has a key impact on scientific and technological innovation and industrial transformation and is also a core supporting factor for building a manufacturing power and is regarded as an important contributor to the national economy. In the past two decades, the number of production and sales of Chinese automobiles has expanded rapidly, and China has maintained its leading position in the world for 15 years. In 2023, China's overall automobile exports increased significantly to 4.91 million units, ranking first in the world for the first time, among which the production and sales of new energy vehicles ranked first in the world, and its exports also achieved a significant growth of 77.6% year-on-year. This marks an important step for China from "automobile giant" to "automobile power". However, in sharp contrast to the vigorous development of the new energy automobile industry, the training of skilled talents in vocational colleges in China is large but not strong, the training goals of school talents are inconsistent with the business economic goals of enterprises, and the phenomenon that enterprises cannot recruit workers and students cannot find jobs occurs from time to time. Therefore, it is imperative to accelerate the integration of production and education and the reform of school-enterprise cooperation "dual" education curriculum.

2. Connotation of dual system teaching mode

Germany first proposed and put into practice the concept of dual education^[1], which was advocated in the face of severe political and economic difficulties after World War II. In response to various social challenges, the German government strongly supported this system, making it a key force in Germany's post-war development. This system of education has succeeded in producing a large number of highly skilled people, which has played a key role in promoting Germany's rapid economic recovery.

Dual education model is an innovative education mode, which requires students to receive vocational skills training and theoretical courses at the same time in schools and enterprises, so that they can master and apply these knowledge to improve their employment competitiveness^[2]. This model is called "duality" because it includes two main elements: theoretical knowledge and vocational skills. This approach gives students the opportunity to apply theoretical knowledge to real-world work, thereby enhancing their practical abilities and needs. Most German vocational colleges adopt this teaching model, and according to the relevant regulations, students must first obtain a secondary school diploma before

applying to study in this mode. Then, they will choose a company as an apprentice base, and under the conditions stipulated in the government signed a training agreement. Finally, they also need to register with the relevant vocational college, thus gaining the right to learn theoretical knowledge. The German dual education model usually lasts for three years, the first two years mainly focus on basic subjects, and from the third year, students can delve into their professional field and complete internship tasks. Therefore, under this model, students have both the role of students and the identity of apprentices^[3], which breaks the limitation of traditional single-line theoretical education and cultivates more practical talents. Its main features are:

(1) The "dual system" talent cultivation strategy is based on employment demand^[3]. The goal of the program is to train excellent technical craftsmen, and its cycle usually lasts from 2 to 3.5 years, during which the education process is rotated between the enterprise and the vocational college, specifically, the vocational school students spend one-third of their time in school, and the remaining two-thirds are spent in the practice of the enterprise. Students receive a monthly living allowance from the enterprise for each part of their schooling, which allows them to have a clear idea of their learning priorities and to participate as paid apprentices, working while learning and learning on the job.

(2) Students in the dual education system mainly spend their time learning practical skills in enterprises, and what they face and learn are the advanced equipment being used in the current industry, and they have mastered the most advanced technology. There are specialized training institutions and trainers in large enterprises, which can implement all-round professional training for students in vocational colleges. Even small enterprises can send their employees to professional training institutions through cooperation. This approach allows students to enter the workforce immediately after completing their studies in skilled jobs that meet the requirements of their positions.

(3) Training and evaluation are independent^[4]. The evaluation of students is usually carried out by an evaluation committee composed of representatives elected by the industry association, the company and the school. In the examination content, the implementation of the separation of teaching and examination and process elimination mechanism, divided into theoretical test and practical test, to ensure the quality of teaching.

3. Problems existing in the current teaching mode

3.1. There is a barrier between the matching degree of talent training supply side and industrial demand side

China's higher vocational colleges have the problem of insufficient deep integration in promoting school-enterprise cooperation. However, in the process of internship, enterprises often only provide internship places, and students are difficult to obtain adequate vocational training, but also lack of effective guidance from enterprise teachers. Due to the obvious disconnect between the on-campus learning content and the actual enterprise work, it is difficult for students to be recognized by the enterprise during the internship, and even more difficult to successfully find employment after the internship. Many schools are limited to inviting business experts to give lectures, organizing entrepreneur presentations and student internships. Although higher vocational colleges are usually equipped with simulated supermarkets and practical training software, these still fail to fully demonstrate the application of classroom theory in practical operation. Taking the major of new energy vehicle technology as an example, there is a large gap between theoretical teaching and practical operation, and students still cannot get access to the real production and operation process of new energy vehicle manufacturing enterprises, and no real in-depth cooperation between schools and enterprises has been formed, which affects students' practical ability and employment competitiveness.

3.2. "School enthusiasm is high and enterprise is low", the interests of the school and enterprise are not unified

In the process of carrying out the dual teaching mode, the school enthusiasm is often high while the enterprise enthusiasm is low. It is no accident that enterprises hold a negative attitude towards the talent development of dual training system. The main reasons are as follows: On the one hand, enterprises need to bear the related operating expenses; On the other hand, many companies are unwilling to invest money that will not pay off in the short term. In addition, because they can easily recruit a large number of low-paid interns in the market, the dual system is not attractive enough for companies to actively participate in vocational education. And, in addition to a lack of corporate initiative, vocational education has a poor

reputation. Most students and their parents see vocational education as an alternative rather than a first choice.

Secondly, the understanding of the connotation of school-enterprise cooperation between the two sides is inconsistent, and the interest goal is not uniform. The benefits are not clear and the enthusiasm of the participants is not high enough. The modern apprenticeship system requires the company to invest in the direct training costs (including course development, materials and consumables, employee compensation, management expenses, etc.) and the apprentice compensation two main parts. The teaching cost of the school is high, and the management is difficult, because interns may encounter unexpected accidents in practice and cause industrial injuries, so the enterprise needs to face some potential risks. All these problems make the situation of "high enthusiasm of schools and low enthusiasm of enterprises" become a reality, which restricts the development of dual vocational education in China to some extent.

4. Implementation of the course reform of "Automotive Electrical Equipment and Principles" under the dual-system talent training mode

4.1. Build a school-enterprise "dual subject" education platform

With the Huzhou Sino-German Green Intelligent Manufacturing and Education Alliance as the platform, and the German-funded enterprises represented by Scheider Precision Parts Huzhou Co., Ltd. as the main partners, we introduce the German "dual system" school philosophy, build a dual system talent training model for "specialized and special new" small and medium-sized enterprises, and focus on exploring the modern management system and advanced green intelligent manufacturing technology of Scheider and other German-funded enterprises. German-funded enterprises participate in the whole chain of cooperative school-running process, fully reflecting the "double main body, double place" and other school-running elements, training talents with both professional knowledge and practical operation ability, and providing high-quality human resources support for the economic and social development of Huzhou region.

The "double main body" education platform is led by the school and the new energy automobile enterprise in the lake, and the dual system leading group is set up to be responsible for the decision-making, supervision and management of major matters of "double main body" education. The school takes the new energy vehicle technology professional group as the main body, and jointly sets up the Steering committee for the construction of the new energy vehicle technology professional group with the enterprises in the Huzhou Sino-German Green Intelligent Manufacturing, production and education Alliance, adopts the teaching mode of "work-study alternation, school-enterprise collaboration" and builds a dual-track curriculum system of "school curriculum + enterprise curriculum". In the process of designing enterprise courses, according to the job tasks, the enterprise's job requirements and corresponding professional norms are integrated into the teaching plan. The course implementation plan is shown in Figure 1.

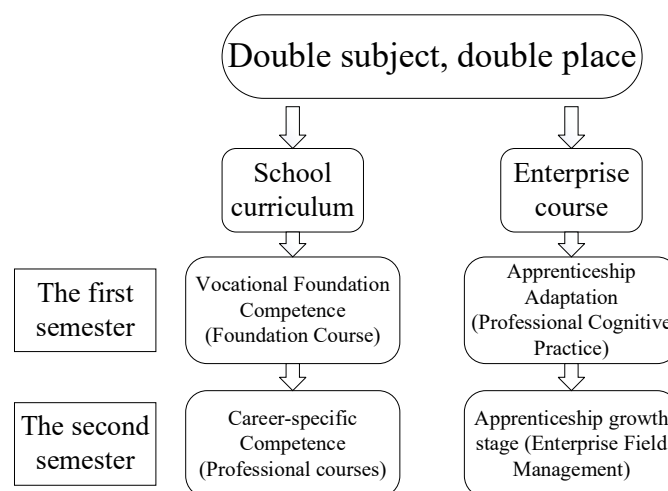


Figure 1: Curriculum implementation plan.

4.2. Dual teaching implementation process

The implementation of this course is divided into four steps, which are: ① Reform of curriculum teaching objectives; ② Reform of curriculum teaching content ③ Reform of curriculum teaching mode; ④Reform of teaching evaluation mode.

4.2.1. Reform of curriculum teaching objectives

The dual teaching mode changes the previous teaching mode which mainly focuses on teaching. It takes solving specific problems as the course goal and imparts knowledge to students while solving problems. In teaching, students are divided into groups first, then specific problems are given to students for discussion, solutions are proposed, and finally the optimal plan is selected for implementation [5]. In this process, the teacher will impart the knowledge to the students and guide the students to master the correct operation method. Based on the "dual system" teaching mode, curriculum objectives are reformed, as shown in Figure 2.

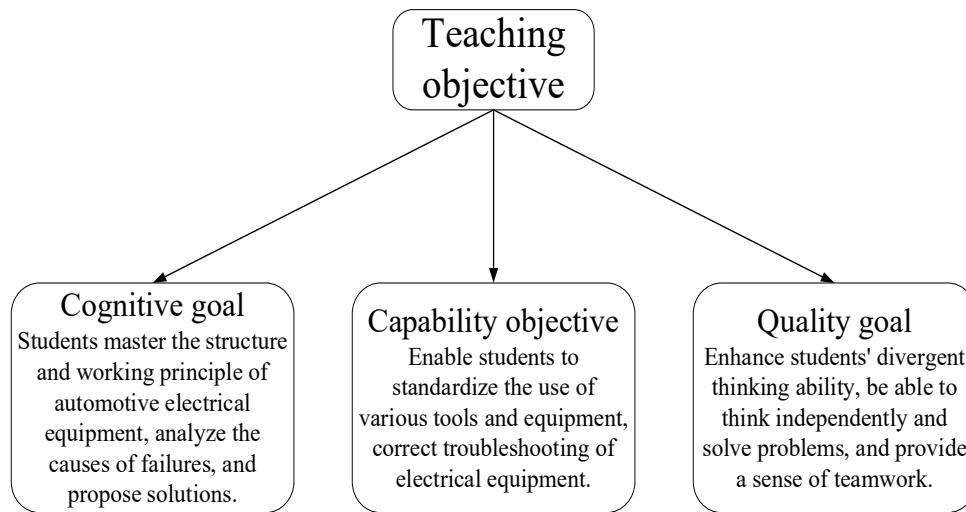


Figure 2: Curriculum implementation plan.

4.2.2. Curriculum teaching content reform

Adopting the "dual system" teaching mode is to take how to solve practical problems as the teaching content, take the typical work tasks in the production practice of enterprises as the teaching project, divide the whole course into seven tasks, and let students master the required knowledge in the process of solving problems, which not only improves students' learning ability, but also improves their practical ability. After graduation, students can work directly, which greatly improves the competitiveness of employment. For example, when talking about the car air conditioning system, we take the poor air conditioning refrigeration effect often encountered in the car maintenance as the task, and pass on knowledge to students while solving the problem, so as to truly combine theory and practice. The typical tasks of this course are shown in Table 1.

Table 1: <Automotive Electrical equipment and principles> typical tasks.

Mission 1	Mission 2	Mission 3	Mission 4	Mission 5	Mission 6	Mission 7
Automotive circuit basic fault diagnosis	Automotive battery use and maintenance	Auto generator disassembly and repair	Disassembly and overhaul of starting system	Inspection and maintenance of safety and comfort systems	Lighting and signal system inspection and maintenance	Automobile air conditioning system overhaul

4.2.3. Curriculum teaching model reform

The traditional teaching mode mainly combines multimedia technology and parts display to teach the main content of the textbook to students.

4.2.4. Reform of curriculum teaching objectives

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4.2.5. Reform of teaching evaluation mode

A dual evaluation system is established, which is evaluated jointly by teachers and enterprise tutors. The weight of process assessment is increased, and the method of process assessment (that is, task assessment) and final evaluation are combined. The evaluation method can be speech, competition, debate, answer and other forms, taking the work task as the assessment unit, and combining theory with practice to carry out comprehensive ability assessment [6]. This assessment method makes the students' performance more reliable and valid. Progress assessment is set according to the task, the assessment of knowledge mastery and technical proficiency is made according to the national vocational skill level examination requirements, and the test of skill level must also meet the industry standards.

5. Conclusions

Since entering the fourth industrial revolution, the automobile industry has witnessed the rapid development of the new four technologies of "electrification, networking, intelligence and sharing", and the demand for high-quality skilled personnel brought about by technological innovation and industrial upgrading is also increasing. In this context, combining with the characteristics of local industries, our school actively promotes the dual education of school-enterprise cooperation, and has carried out active exploration and practice in the aspects of talent training, curriculum construction and teacher promotion. In the new era, it is necessary to continue to deepen the dual-system soil, constantly optimize the cooperation mechanism and safeguard measures, and walk out of a road of dual-system with Chinese characteristics to make a small contribution to the development of China's new energy automobile industry.

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