Exploration on the Promotion of Teachers' Theoretical and Practical Ability Based on Teacher Training

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Abstract. To achieve the goal of talent training in the field of automobile electronic control, it is necessary to build a teaching team with theoretical knowledge and innovative practice ability. Therefore, the school of mechanical engineering of Jinan University and shandong xingyuan intelligent network technology Co., Ltd. launched a teacher training project. This paper analyzed the importance of teacher training for automobile electronic control based on engine fuel supply system, and put forward the characteristics, highlights and research contents of this project. Furthermore, important measures to improve the effect of teacher training were obtained, including making training plans, strengthening theoretical teaching, inviting technical experts from enterprises to guide the school, improving the ability of practical innovation, and going deep into the investigation and study of automobile enterprises. Finally, the students' self-evaluation questionnaire survey, the theoretical knowledge and on-site practical ability test were conducted to evaluate the undergraduates who started classes in 2023 and 2024. The results showed that the theoretical level and practical ability of the students were improved after the teacher training of cooperation between industry and university. This also indirectly indicated that, teachers' teaching and practical abilities were improved through the teacher training project of industry and university.

Keywords: theoretical and practical ability; collaborative education; teacher training; industry-university cooperation; automobile electronic control

1 INTRODUCTION

As an important institution to cultivate high-level talents with both theoretical knowledge and innovative practice ability, universities have a direct impact on the quality of personnel training. With the rise of emerging industries such as artificial intelligence, big data and new energy, the demand for high-level talents in society has greatly increased. Universities need to build a team of teachers who can keep up with the development trend of science and technology and master cutting-edge technology, so as to cultivate students' professional skills and innovation ability, meet the talent demand of emerging industries and help upgrade traditional industries[1-4]. In order to

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improve the training level of talents in universities, the ministry of education has put forward the cooperative education project between industry and university, in which the teacher training project is one of the most important research contents. Through the teacher training program, the teachers in universities can quickly have the ability to combine theoretical knowledge with practical operation. Teachers go deep into enterprises to conduct research and study, bring cases and problems in enterprises into the classroom, and help students master the skills of solving practical problems. [5-7].

To achieve the goal of cultivating talents in the field of automobile electronic control, it is necessary to solve the problem of cultivating students' innovative ability and practical ability, and the key to solve this problem lies in the construction of teaching team with theoretical knowledge and innovative practical ability. So, the school of mechanical engineering of Jinan University and shandong xingyuan intelligent network technology Co., Ltd. launched a teacher training program. Focusing on the current technical hotspots in the automotive electronic control industry, shandong xingyuan intelligent network technology Co., Ltd. will carry out courses discussion and technical training to help cultivate young teachers' curriculum construction level and innovative practical ability. At the same time, the theory of automotive electronics owned by college teachers can promote the research and further promotion of related automotive electronic control equipment of shandong xingyuan intelligent network technology Co., Ltd. This teacher training project closely focuses on the knowledge of automobile electronic control, which provides important help to improve the practical teaching level of front-line teachers, and also promotes the theory of automobile electronic control in enterprises, realizing the complementary advantages and win-win cooperation between schools and enterprises.

2 FOUNDATION OF TEACHER TRAINING OF AUTOMOBILE ELECTRONIC CONTROL BASED ON ENGINE FUEL SUPPLY SYSTEM

Relying on automobile electronic control specialty, the school of mechanical engineering of Jinan University applied for the teacher training program of automobile electronic control based on the engine fuel supply system. The school of mechanical engineering has a strong faculty and a high-level teaching and research team, including the provincial teaching team, famous teachers, Taishan scholars and provincial excellent course teachers. At present, it undertakes a number of scientific research and teaching and research projects, such as the national key R&D plan, the National Natural Science Foundation, and major innovative projects in Shandong Province. The school of mechanical engineering has advanced experimental instruments and equipment such as processing, detection and control, large-scale three-dimensional design, analysis and simulation platform software, and a variety of automobile electronic control equipment such as distance sensor signal acquisition system, electronic control steering system, electric power steering training platform, electronic control suspension test platform and electronic control engine fuel supply system test platform, as shown in Fig.1. Advanced experimental equipment and engineering training condi-

tions provide a solid foundation for the cultivation of innovative consciousness, engineering ability and comprehensive quality of students majoring in automobile electronic control, and also lay a foundation for the subsequent teaching reform.

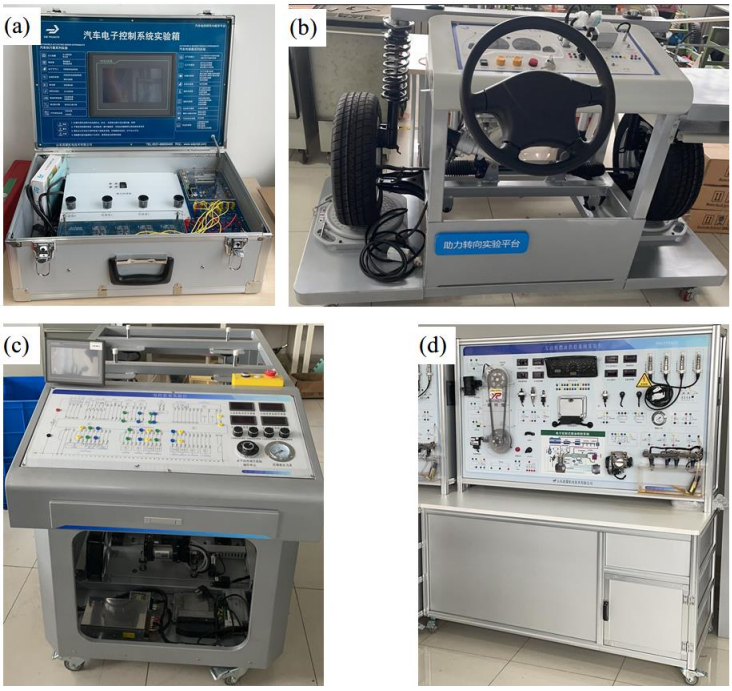

Fig. 1. Automobile electronic control equipment: (a) electronic steering control system; (b) electric power steering training platform; (c) electronic control suspension test bench; (d) engine fuel supply system test bench

3 CHARACTERISTICS OF TEACHER TRAINING PROGRAM OF AUTOMOBILE ELECTRONIC CONTROL

In order to serve the national strategy and provide strong talent support for regional economic development, applied undergraduate education needs to cultivate more high-level skilled craftsmen. To complete this historical task, it is necessary to build a high-quality and high-level "double-qualified" teaching staff. This project is based on the teacher training project, and carries out the teacher training of automobile electronic control based on engine fuel supply system. The main features are as follows:

(1) Compared with the general project-based training concept in which expert reports, special lectures and other one-way teaching are the main forms, the teacher training of this project takes the actual needs of participating teachers as the core and pays attention to the accelerated growth and personality development of teachers, which is more targeted.

(2) In order to determine the training content and training plan, and fully understand the teachers' demand for the course content and experimental practice, it is planned to conduct a full investigation on the teachers of relevant courses in the school of mechanical engineering, and analyze the training experience with previous teachers, and finally determine the training content and plan.

(3) According to different teachers' needs, the training content is adjusted step by step, so as to make a reasonable training plan, offer flexible training courses and determine the appropriate training and teaching content. Using theoretical teaching, skill training, special lectures and other training methods, the organization of teaching is more standardized, and the teaching tasks are earnestly implemented, thus ensuring the rationality and scientificity of the teacher training plan.

(4) Focusing on automobile electronic control based on engine fuel supply system, the concept of strengthening practical teaching is put forward by taking teacher training and relying on the cooperation of industry-university-research. Teach relevant important knowledge to students, and cultivate students' ability to analyze and solve practical engineering problems by using the theoretical knowledge they have learned.

4 CONTENTS OF AUTOMOBILE ELECTRONIC CONTROL TEACHER TRAINING PROGRAM

(1) This teacher training project always adheres to the principle of "full investigation and scientific demonstration", combines the valuable experience of previous teacher training and meets some new requirements of current teacher training. And the content and plan of teacher training is scientifically formulated.

(2) Different teachers have different theoretical and practical training requirements, so they are trained in different categories. In order to improve the effectiveness of teacher training, a hierarchical and advanced training method is used in the content of teacher training. That is, by introducing theoretical teaching, giving targeted lectures in special lectures and strengthening theoretical understanding in skills training, training programs and courses are formed. In the content of teacher training, hierarchical and advanced training is used to form training programs and courses.

(3) Teachers' training adheres to the guiding principle of optimizing the process and improving the actual effect. By continuously strengthening training management, the participation in the whole training process is improved, and teachers' enthusiasm and initiative are mobilized as much as possible. At the beginning of the training course, various forms of activities such as pre-interpretation of the teacher training program, study group discussion, discussion and exchange were carried out. In the process of training, encourage and support teachers to actively participate in the process management of teacher training and enhance mutual trust. Under the mechanism of training process management, the smooth development of teacher training is ensured, so as to improve teachers' teaching level.

5 IMPLEMENTATION MEASURES OF AUTOMOBILE ELECTRONIC CONTROL TEACHER TRAINING PROJECT

In order to carry out the teacher training project smoothly, according to the content of the project construction, various teaching methods are comprehensively used to implement the project. The details are as follows:

(1) Develop training programs. Fully investigate and demonstrate the different requirements of different teachers for theoretical and practical training, and scientifically formulate teacher training content and training plan according to the new requirements of teacher training.

(2) Strengthen theoretical teaching. In the hierarchical and advanced training stage, taking the teaching of automobile electronic control based on engine fuel supply system as an example, the composition and working principle of engine fuel supply system are explained by theoretical teaching, and experts are invited to interpret the theoretical links of automobile electronic control based on engine fuel supply system in detail, so that teachers can further understand the course theory.

(3) Invite enterprise technical experts to enter the school for guidance. Inviting experts from automobile enterprises to give special reports and guide the discipline construction of automobile electronic control specialty, will effectively improve the knowledge of applied technology of teachers, and supplement the shortage of applied technical talents of automobile electronic control specialty.

(4) Improve the ability of practice and innovation. After fully explaining the composition and working principle of the engine fuel supply system, teachers are trained in practice. And the fuel pumping, throttle control, spark plug electronic ignition, fuel electronic injection and other processes are demonstrated on the engine fuel supply system test-bed in the college laboratory, so that the training teachers can better understand the working principle of the engine fuel supply system and the knowledge of automobile electronic control involved.

(5) In-depth investigation and study of automobile enterprises. The school organizes teachers majoring in automobile electronic control to study in automobile enterprises, visit the production process of enterprises under the guidance of technicians. Through in-depth investigation of enterprises, teachers of automobile electronic control specialty have improved their knowledge level, enriched teaching content of automobile electronic control specialty and increased application of new technologies in teaching.

(6) Guide the construction of laboratories. There is a great relationship between the cooperative enterprise and the vehicle laboratory. The enterprise experts are familiar with the products of automobile electronic control, and have been engaged in the laboratory construction in universities for many years. So they have very mature experience in laboratory construction and rich experience in experimental equipment training. By inviting enterprise technical experts to school for training, lectures or guidance, enterprise experts guide the design of vehicle laboratory and draw the laboratory layout, as shown in Fig. 2, to further improve the laboratory construction in universities and improve teachers' experimental skills.

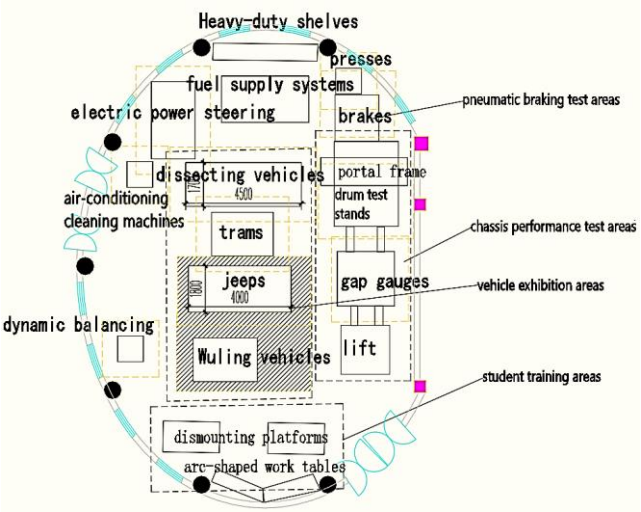

Fig. 2. Planning of automotive electronic control laboratory

Through the teacher training of automobile electronic control based on engine fuel supply system, combined with the characteristics of automobile electronic control specialty, the connotation of teacher training is deeply dug, and constructive project construction experience is obtained, as shown in Fig. 3, which further improves the theoretical and practical level of teachers of automobile electronic control specialty.

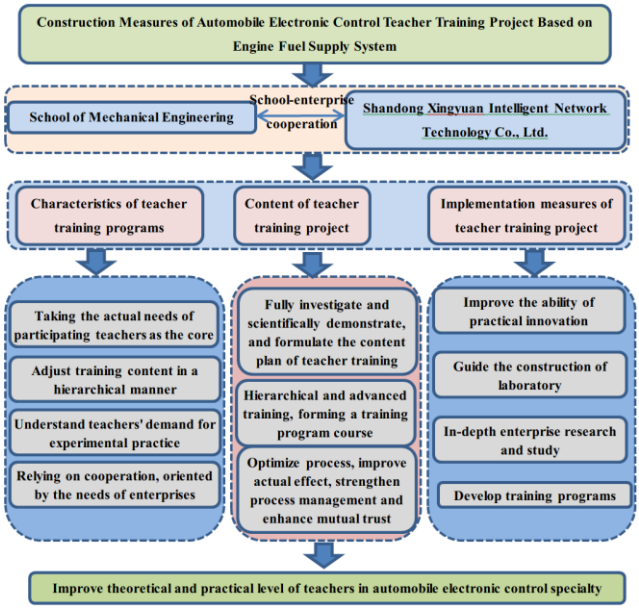

Fig. 3. Construction measures of teacher training program for automobile electronic control based on engine fuel supply system

6 EFFECT TEST OF ELECTRONIC CONTROL TEACHER TRAINING

6.1 Self-evaluation of Students

The ultimate goal of this teacher training is to improve students' theoretical knowledge and practical ability. First, a self-evaluation questionnaire survey was conducted among students who chose this course in mechanical college. The questionnaire survey includes students' interest in learning, mastery of theoretical knowledge, disassembly and assembly, operation ability of electronic control system, etc., to evaluate students' achievement in theoretical knowledge and practical ability. Undergraduate students who started classes in 2023 and 2024 were selected, and 60 copies were distributed respectively, and 120 copies were recovered. Among them, the teachers in 2024 have passed the teacher training program, while the teachers in 2023 have not received teacher training. The results of students' self-evaluation are shown in Table 1.

Table 1. Students' self-evaluation of theoretical knowledge and practical ability of automobile electronic control

Project	Very helpful(%)		Generally helpful(%)		No help(%)	
	2023	2024	2023	2024	2023	2024
Improving learning interest	83	93	15	7	2	0
Mastering theoretical knowledge	86	95	11	5	3	0
Analysis ability of electronic control	84	94	11	6	5	0
Operation ability of electronic control	82	93	14	7	4	0
Ability to solve problems in automotive electronic control	85	92	9	8	6	0

As can be seen from Table 1, in 2024, the students' interest in learning, the mastery of theoretical knowledge and the improvement of practical ability exceeded those in 2023. This is because, in 2024, after the teacher training project of industry and university, the teachers went deep into the enterprise for investigation and study, and their own theoretical level and practical level were greatly improved, so that in the teaching process, they could combine theory with practice and impart more knowledge to students, and students' interest in learning was improved, and their theoretical level and practical ability were also improved.

6.2 Test Paper and Field Practice Ability Test

In order to test students' theoretical knowledge, disassembly and assembly ability and operation ability of automobile electronic control, the undergraduate students who started classes in grade 2023 and 2024 were evaluated by examination papers and field practice ability tests, and the test results are shown in Fig. 4.

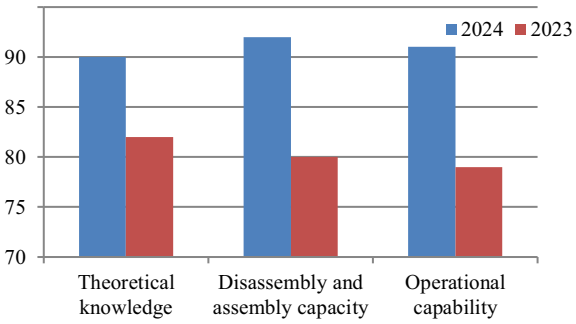

Fig. 4. Results of theoretical test and practical ability test

As can be seen from Fig. 4, the theoretical knowledge, the disassembly and assembly ability and the operation ability of electronic control system of students in 2024 have been greatly improved compared with those of students in 2023. This also indirectly indicated that the teacher training project of industry and university has improved teachers' theoretical level and practical ability.

7 CONCLUSIONS

To achieve the goal of talent training in the field of auto-mobile electronic control, the school of mechanical engineering of Jinan University and shandong xingyuan intelligent network technology Co., Ltd. launched a teacher training project. This paper analyzed the importance of teacher training for automobile electronic control based on engine fuel supply system, and put forward the characteristics, highlights and research contents of this project. Furthermore, important measures to improve the effect of teacher training were obtained, including making training plans, strengthening theoretical teaching, inviting technical experts from enterprises to guide the school, improving the ability of practical innovation. Finally, the students' self-evaluation questionnaire survey was conducted, and the theoretical knowledge and on-site practical ability test were conducted to evaluate the undergraduates who started classes in 2023 and 2024. The results showed that the theoretical level and practical ability of the students were improved after the teacher training of cooperation between industry and university. This also indirectly indicated that, teachers' teaching and practical abilities were improved through the cooperative education project of industry and university.

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