

Construction and Research of the Practical Teaching System of Vehicle Engineering Major Based on the Concept of "New Engineering"

Wangping Jiang*, Wenjie Zai

Wuhan Huaxia University of Technology, Wuhan, China

*corresponding author.

Keywords: New Engineering; Engineering Education; Talent Training Mode; Innovation.

Abstract: To respond to the call of the Ministry of Education to promote "new engineering" and adapt to the development of higher education, the vehicle engineering major explores and constructs a practical teaching system suitable for their own use by learning from the talent training mode of engineering education. In this paper, the theory of "new engineering" education mode, the current situation of practice teaching system of vehicle engineering major, the training mode of engineering education talents and the construction of practice teaching system of vehicle engineering major based on the concept of "new engineering" are studied in order to promote the improvement of innovative practice ability of college students and further promote the disciplinary construction of vehicle engineering.

1. Research Background

Under the background of new economy and emerging industries, in the construction of new engineering courses, we should set up and develop a number of emerging engineering majors on the one hand, and promote the reform and innovation of existing engineering majors on the other hand. In February 2017, the Ministry of Education launched the research on the development of "new engineering" in an all-round way, and discussed the connotation and characteristics of new engineering as well as the path of its construction and development^[1]. The construction of new engineering courses has set off a new upsurge of teaching reform in China's higher education circle.

With the vigorous development of "new engineering", Chinese scholars have also proposed that in order to gain an advantage in the employment competition, private colleges and universities should cultivate talents according to the actual situation of running a school in combination with "new engineering". Xia Jianguo et al. proposed that colleges and universities should find out their own role under the background of "new engineering", insist on serving the local and cultivate engineering and technology application talents. Yan Fengxin introduced the "Melbourne Model" guiding teaching, general training and cross-disciplinary integration methods by studying the professional core course Mechanical Design of the University of Melbourne in Australia, and placed great emphasis on cultivating students' theory of major engineering and building a diversified practical teaching curriculum system^[2-3], which provides a new idea for the construction of practical teaching system of vehicle engineering major.

Practical teaching links such as professional experiments and practical training play a very important role in cultivating students' basic knowledge and skills and improving their engineering practice and innovation ability. At present, as there is a certain gap between the curriculum and teaching content of vehicle engineering major and practical needs, this paper intends to solve the following main problems in practical teaching: (1) Less design-oriented, comprehensive and innovative experiments, and relatively lagging cross-curricular practice projects and experimental base construction; (2) Lack of participation of relevant industry personnel in the formulation of practical curriculum system, and a relatively single talent cultivation goal; (3) Failure of practical teaching content to fully meet the "graduation requirements" for students in Standards for Engineering Education Accreditation; (4) Relatively insufficient "double-qualified" teachers, and lack of the background of engineering practice of some teachers.

In this paper, based on the concept of "new engineering", under the new background that vehicle engineering is the first-class major in the province, the uniqueness of teaching subjects in private universities and the target orientation of engineering practice teaching reform were discussed, and the construction and research of practical teaching system of vehicle engineering major based on the concept of "new engineering" were put forward.

2. Construction of Practical Teaching System of Vehicle Engineering Major based on the Concept of "New Engineering"

2.1. Building a laboratory with complete teaching and scientific research functions and obvious major features based on the goal of personnel training

It is necessary to step up the construction of laboratories and actively declare the upgrading and renovation projects of relevant laboratories in the direction of professional intelligent vehicles and new energy vehicles in vehicle engineering. Moreover, based on the goal of personnel training, facing the needs of society, especially enterprises, a laboratory with complete teaching and scientific research functions and obvious major features should be constructed, basically forming a new experimental teaching system to cultivate students' skill level and application ability.

The existing verification experiments should be reformed to increase the proportion of comprehensive and design experiments. Innovation and reform should be carried out in the setting of major courses and experimental items, and smart car courses and comprehensive design experiments should be added, so as to enhance the matching degree between majors and industries and improve students market competitiveness. The development process of the intelligent car in the whole life cycle is realized by drawing design→discussing and determining the scheme→drawing PCB with PROTEL or AD software→punching out circuit boards→purchasing chips and electronic components→welding complete circuit boards→ADS software debugging→burnprocess→mobilizing vehicles, to train students to become high-quality technical talents who "understand the principles of automatic driving, master chips, and be familiar with codes and algorithms".

2.2. Realizing the integration of production and education, and the integration of science and education in collaborative education on the personnel training mechanism

Relying on the construction of practice bases inside and outside the university, the university-enterprise cooperation platform should be constructed to realize the in-depth cooperation between universities and enterprises^[4-6]. Student practice platform and teacher research platform should be built through Industry-University-Research cooperation, aiming at the needs of automobile industry chain and value chain, such as building the "Future Star" Automobile Industry-University-Research Studio and Huaxia Automobile Evaluation and Technical Service Studio. Through the studio mode, students can participate in every practical project, mainly in the form of mentoring, so that they can fully understand the contents needed by a complete project, possible problems and countermeasures, and form a post-oriented, multi-directional development model of students' comprehensive quality and ability.

2.3. Improving the quality monitoring and evaluation mechanism of practice teaching according to the requirements of the Standards for Engineering Education Accreditation for "new engineering"

In accordance with the requirements of the new engineering construction, the school and the cooperative enterprise shall jointly formulate the personnel training standards and training programs in terms of personnel training scale and training programs, in combination with the industry development trend and the suggestions put forward by the experts. The quality standard system of engineering personnel training, and the quality standard of vehicle engineering personnel training should be strengthened. Based on the "graduation requirements" for students in Standards for Engineering Education Accreditation, the existing practice teaching system should be reformed and optimized to provide a theoretical system and practical basis for graduates to achieve the ability to

solve complex engineering problems^[7-8], and the existing practice teaching system should be reformed and optimized, so as to establish an automobile talent training system that meets the engineering education certification standard and improve the engineering education level.

2.4. Optimizing the content and method of practical teaching

2.4.1. Online and offline flipped class mode

Since traditional practice teaching is mostly guided by the syllabus, which makes students understand and be familiar with the experimental process, with relatively single experimental items, it can not effectively stimulate students' learning enthusiasm and open thinking. By setting the experimental theme online, students can independently consult materials in groups, design experimental schemes, and evaluate different schemes to find the best strategy. Then through the off-line experimental instruments and equipment, the scheme is improved and adjusted. Finally, the data are collected and the results are analyzed to consolidate the theoretical basis.

2.4.2. Integrating teaching and research projects into open experimental teaching

Because the planned practical teaching is relatively fragmented, students can enter the laboratory after school for a large period of time to participate in the tutor's teaching and research project research guided by innovative results, to systematically learn, analyze and optimize an assembly or component, to achieve the purposes of accurate mapping, design parameters, three-dimensional simulation and optimization results, to inspire their innovative thinking and cultivate their practical ability and innovative ability.

2.4.3. Integrating discipline competitions into classroom

Relevant practice platforms should be set up through the National University Students Intelligent Car Race, Mechanical Innovation Contest, Challenge Cup, Energy Conservation and Emission Reduction Competition, Formula Student China, Honda Energy Games and National 3D Digital Innovative Design Competition, etc. to enable students to truly participate in engineering practice projects, consolidate their theoretical foundation and improve their comprehensive practical ability. Combining college students' competitions with curriculum construction, reform and personnel training, competition items are introduced into theoretical teaching, and the specific tasks and practices of competition items are integrated into experimental training. Through the combination of "class and competition", the teaching and learning can be promoted by competition, to train students' ability to apply what they have learned, to perfect and elevate students' quality of hands-on analysis and design by subject competition, thus comprehensively improving the practice and innovation ability of students in colleges and universities of applied technology. For example, the intelligent automobile competition team of vehicle engineering can give full play to the role of "transmission, help and guidance" of the key players. It can effectively mobilize the students' learning enthusiasm, promote the improvement of the students' innovative practical ability, and help the students to learn Automotive Single Chip Microcomputer, Automatic Control Principle, C Language, Automotive Electrical and Electronic Control Technology, electronic practice of automotive circuits, and comprehensive practice of automotive electronic control, etc. faster.

2.4.4. Introducing high-level talents and increasing the construction of double-qualified teachers

By means of training and practical exercises, the training of teachers should be strengthened, and young teachers should be sent to enterprises or laboratories to obtain opportunities for direct practical exercises in production and scientific research. The professional level of laboratory technicians should be further improved to form a scientific research laboratory team with reasonable structure, solid professional knowledge, strong practical ability and adaptability to the needs of discipline construction.

3. Conclusions

The reform of automobile practice teaching based on the concept of "new engineering" provides support for the professional certification of engineering education for vehicle engineering major, and plays a certain role in deepening school-enterprise cooperation. The research results will strengthen the practical teaching system, deepen the exploration and reform of practical education, provide a certain value of reference for the practice teaching management of vehicle engineering major and the reform of undergraduate talent training mode, help to cultivate application-oriented talents with engineering practice and innovation ability that meet the needs of the new industry, and serve as a model for vehicle engineering major to cultivate talents facing social needs, adjust personnel training programs, and improve personnel training quality.

Acknowledgements

This work is supported by School-level Teaching and Research Program of Wuhan Huaxia University of Technology "Construction and Research of the Practice Teaching System of Vehicle Engineering Major Based on the Concept of "New Engineering" " (Project number: 2022); First-class Undergraduate Professional Construction Site in Hubei Province-Vehicle Engineering (Project number: 201902).

References

- [1] Wang Jianting. Taking new engineering as the starting point to promote the connotation construction of first-class undergraduate education. *China Construction Education*, 2019, (2): 35-39.
- [2] Wei Jianwei, Chen Xiaoping, Ruan Liangjun. Construction of practical teaching system of vehicle engineering major under the background of "Pan-Engineering Concept". *Journal of Ningbo Institute of Technology*, 2017, 29(1):61-65.
- [3] Wei Hanbing, He Shaochuan. Construction of trinity practical teaching system of "teaching-guidance-innovation". *Experiment Science and Technology*, 2019, 17(5): 32-37.
- [4] Pan Binfeng, Sun Yuan. New exploration of professional teaching reform under the background of "new engineering"-based on a case study of "Mechanical and Electronic Engineering" major in Shanghai Dianji University. *Journal of Shanghai Polytechnic University*, 2019, 36(4): 314-320.
- [5] Zhang Zhihong, Zhou Yuqing et al. "New Engineering" concept and analysis and thinking of engineering major training in China. *Higher Education of Sciences*, 2018, 141(5): 94-102.
- [6] Yan Fayi, Wu Yalan et al. Research on the curriculum system reform of vehicle engineering major-based on a case study of Shandong Jianzhu University. *Journal of Shandong Jianzhu University*, 2015, 30(5): 500-505.
- [7] Duan Min, Shi Jing et al. Experimental (practical) teaching system of new energy automobile engineering major. *Journal of Liaoning University of Technology (Social Science Edition)*, 2016, 18(2): 106-111.
- [8] Xu Wenjuan, Zhao Qiufang, Dong Xu. Research and practice of practical teaching assessment system for applied vehicle engineering undergraduate. *Journal of North China Institute Of Aerospace Engineering*, 2017, 27(1): 53-55.