

Teaching Reform of Vehicle Engineering Specialty based on Outcomes-based Education Concept

Yiqun Liu ¹, Xiaojing Zhou ^{2†}, Yanyun Chen ¹, Pengwei Dong ¹

1. School of Automotive Engineering, Harbin Institute of Technology, Weihai 264209, China

2. Finance Department, Harbin Institute of Technology, Weihai 264209, China

†Email: lyq.new@163.com

Abstract

In view of the problem of the teaching effect of the vehicle specialty courses, this paper analyzes the training objectives of the courses, determines the teaching contents and relevant teaching methods, and provides specific teaching measures to improve the students' ability to solve practical problems and employment ability, so as to cultivate the application-oriented talents with innovation ability and practical ability that meet the needs of the society.

Keywords: Education and Practice; Outcomes-based Education; Curriculum Teaching; Vehicle Engineering Specialty

1 INTRODUCTION

OBE (Outcomes-based Education), the education model based on learning output, a philosophy of education based on students, the reform of basic education first appeared in the United States and Australia. In the book "output-based education model: controversy and answer", OBE is defined as "clearly focusing and organizing the education system around ensuring that students gain experience of substantial success in their future lives." In the OBE education mode, what students learn and whether they succeed are far more important than how and when to learn. The education structure and curriculum are regarded as means rather than purposes. Educators must have clear evidence of the ability and level that students should achieve when they graduate. The simultaneous interpreting of students' output rather than textbooks or teachers' experience is a dynamic concept that drives the operation of the education system. Then it seeks to design a suitable educational structure to maintain the power, which is obviously contrasted with the traditional content driven and input oriented education. In this sense, OBE education model can be regarded as an innovation of education paradigm.

OBE, (Outcomes-based Education), requires that schools and teachers should first make clear the learning results, cooperate with the multiple elastic personalized learning requirements, let students complete the challenges of self-realization through the learning process, and then feedback the results to improve the original curriculum design and teaching.

2 APPLICATION SIGNIFICANCE OF OBE IN VEHICLE ENGINEERING

Students majoring in vehicle engineering mainly study the basic theory, technology and design method, manufacturing process and marketing knowledge of mechanical products and equipment in vehicle engineering and related fields. They are basically trained in modern mechanics, electrical electronics, automobile design, computer-aided design and marketing management. They should have the ability to conduct technical research and design of automobile and auto parts Basic capabilities in manufacturing and automobile marketing management. The huge automobile market is in urgent need of a group of talents with automobile engineering design, manufacturing, experiment, application, research and automobile marketing and other automobile professional knowledge, especially the demand for senior automobile and new automobile design and development talents, which provides a

broad development space for the students of vehicle engineering. Similarly, in this environment, the requirements of the society, research institutes and enterprises for the students of vehicle specialty are also constantly improving. What they need is the adaptive application talents who keep up with the development of the technology of the times [1].

However, the students of vehicle major are now in the situation of many courses and few class hours. In the past four years, the students need to study general courses, basic courses of mechanical major and master basic knowledge and professional skills of vehicle engineering. The class hours of many courses are very limited. In the classroom teaching, the students often can only learn surface knowledge but not get more in-depth learning, for example, it is impossible to learn and communicate in class for complex engineering problems [2]. If OBE is introduced into the course teaching of vehicle specialty, this kind of output-based education mode can make teachers better turn the goal of imparting theoretical knowledge into the goal of training application-oriented talents. The introduction of OBE concept into the personnel training program of vehicle specialty can play a positive role in training students' knowledge, ability, quality, etc [3].

3 THE ESTABLISHMENT OF CURRICULUM TRAINING OBJECTIVES

Make clear the goal of course teaching, that is, make clear what students will and can do after the completion of course teaching, take the output of teaching results as the guide, design the teaching mode, teaching content, teaching means and assessment methods of the course according to the teaching goal of the course. Determine the teaching objectives of the course, the relationship between the course and other courses, and make assessment and evaluation of the course learning according to the graduation requirements. The assessment and evaluation are divided into two parts: one is to examine the degree of students' mastery of the course content knowledge; the other is to examine the degree of students' application of knowledge and skills. Assessment and evaluation is an important basis for continuous improvement of curriculum teaching. The vehicle specialty needs to cultivate application-oriented talents with social needs and innovative and practical abilities. The teaching needs to cultivate engineering talents according to relevant industry standards. The innovation and practical abilities of students need to be strengthened [4].

Through the quantitative analysis of the innovation and practice ability of the vehicle major students in recent years, it is found that most of the students are lack of innovation ability and innovation knowledge reserve, and their professional knowledge and skills are not solid. At present, most of the teachers focus on theoretical knowledge education, lack of the link of combining theory and practice. Students also focus on the learning of curriculum theory, focus on memory learning, and pay less attention to the practice link, which leads to the phenomenon of weak practical ability. The mastery of professional basic knowledge and skills is the basis and premise for students to have innovative ability and truly achieve innovation. At the same time, professional knowledge should be combined with professional skills, such as using professional software and solve problems in learning or practice, and deepen the understanding of professional basic knowledge in practice [5].

According to the actual requirements and existing problems, based on the concept of OBE, the objectives of classroom teaching are as follows: (1) have a solid professional knowledge of vehicle engineering; (2) have the ability to skill fully use tool software, such as using CAD, SOLIDWORKS, MATLAB, ANSYS and other professional software; (3) be able to use the knowledge learned to solve some practical engineering problems; (4) have good communication and expression ability, moral quality [6].

4 THE SETTING OF COURSE CONTENT

The ability of applied talents includes the ability of understanding and mastering theoretical knowledge, the ability of innovation and the ability of social practice. Therefore, the teaching content should be engineering oriented, broaden the foundation, improve the ability and attach importance to the application. On the way of training applied talents, there are still some obvious problems in teaching in some colleges and Universities: the mode of talent training has not been updated, it is still the old mode that takes theoretical knowledge education as the teaching focus, and takes ability training and comprehensive skill practice as the teaching supplement; The assessment system is still a study of theoretical knowledge of memory type, lacking the assessment of practical application of professional knowledge

and skills; The training mode is not scientific and systematic. The application-oriented talents can use and create a large amount of knowledge accurately and normatively. However, in the actual teaching, the phenomenon of partial theory teaching or blind practice often occurs. The introduction of OBE concept in teaching, so that learning results become the goal and curriculum content setting direction, can better avoid the above problems [7].

4.1 Combination of Theory and Practice

First, the content of classroom teaching can't be just instilling theoretical knowledge. We should sort out the knowledge system, select the teaching content, and make students learn by themselves in simple parts, which can also cultivate students' self-learning ability. Simplify the teaching content and avoid the waste of class hours. Moreover, the teaching content should be combined with practical engineering problems or the latest industry development content, which can not only deepen students' understanding and application of theoretical knowledge, but also enable students to understand the practicality of the learned knowledge, so as to improve students' enthusiasm and initiative in learning. For example, the basic structure of Harbin Institute of Technology (Weihai) HRT formula racing team is interspersed with the course construction of automobile structure to increase the enthusiasm and participation of students, which is also the full use of existing resources, so that the teaching quality can be improved. The real mastery and application of professional basic knowledge and professional skills cannot be separated from specific practice. Practice can cultivate students' independent thinking ability, practical ability and knowledge acquisition ability in the laboratory, even in enterprises and society.



FIG. 1 HARBIN INSTITUTE OF TECHNOLOGY (WEIHAI) HRT FORMULA RACING TEAM

4.2 Teaching Content Is Closely Related to The Society

Application talents will serve the society after all, so the cultivation of application talents needs to be closely linked with the society. According to the data survey, the United States implements the integration of classroom teaching and social enterprise education. The school is responsible for the theoretical part and the enterprise is responsible for the skills and practice part. The students will have the enterprise technical support during the internship. The enterprise becomes the second classroom for the students. According to the specific positions, it pays attention to training the students' professional and practical abilities. In general, American colleges and universities have special institutions equipped with professional personnel office to take charge of the cooperation between enterprises and colleges and universities. The purpose of this kind of education mode is to cultivate talents with excellent post adaptability who combine theory with practice [8].

Colleges and universities should strengthen the contact between schools and enterprises. First, they should make clear the requirements of society and enterprises for students majoring in vehicles, what abilities students should have. According to the requirements of enterprises for talent recruitment, combined with the employment situation and feedback information of graduates majoring in vehicles in the past two years, they should classify the working abilities needed for posts in vehicles. At the same time, there are institutions and departments that are specialized in contacting enterprises to set up teaching contents based on the specific requirements of professional posts, to effectively cultivate students' comprehensive professional ability. For the students' practice and exercise, they should not be limited to the students who will graduate. They should have different degrees of learning in each stage of the University, such as participating in enterprise visits in the lower grades, understanding the current situation and culture of the enterprise, as well as the current situation of the industry, etc., while the higher grades focus on

learning professional technology, etc. In the post practice facing the society and enterprises, we should strengthen the training of post quality and comprehensive professional ability. Students should not only go out of the society, but also let the enterprise talents of vehicle specialty enter the campus. Build professional classroom, contact the existing course knowledge points, find the connection between subject knowledge and practical application of enterprises, and cultivate students' practical ability; In the teaching content, the actual safety production problems in the enterprise, the specific content of the work type operation, the safety inspection technology of the equipment, the recognition of the product quality system certification, etc. are added; Combining with the actual work cases, teaching can highlight the practicability of the project, increase students' interest and enthusiasm for learning; it can be guided by the actual project of the enterprise, driven by the practical task, simulate the actual working environment, improve students' comprehensive professional quality and post ability, and improve students' employability [9].

4.3 Build Virtue and Cultivate People, Take Virtue as The First

Build virtue and cultivate people, take virtue as the first. Ideological and political work should run through the whole process of teaching. It is to train outstanding talents who have the courage to take on responsibilities and have both moral and talent at the same time of completing their studies. Moral education should always be integrated into teaching. Only engineering talents with morality and integrity are the talents that the society really needs [10].

5 THE APPLICATION OF TEACHING METHODS

OBE theory is an educational model based on learning output, which focuses on the cultivation of students' learning achievements and comprehensive abilities. With the continuous development and innovation of modern education technology, there are many teaching methods are also entering the classroom, such as flipped classroom and split classroom. These teaching methods and modes have broken through the traditional education mode and injected new impetus into the education and teaching reform. Combining the OBE concept with the new teaching mode will inject new vitality into the education and teaching in the new era. Flipped classroom can also be translated as "flipped classroom", which means readjusting the time inside and outside the classroom and transferring the decision-making power of learning from teachers to students. Before class, students complete their own learning and information collection by watching videos, electronic documents, books, etc. In class, students mainly focus on Project-based Learning and research together to get a deeper understanding of knowledge [4]. At the same time, teachers can avoid the problems of repeated teaching and irrigation teaching, and have more time to communicate with students in-depth. For example, on the basis of students' certain knowledge reserve, they can explain some complex practical engineering problems. After class, let students get more real learning through practice. However, flipped classroom also has some limitations, for example, in the case of a large number of classes and limited class hours, teachers' energy is limited, and they cannot answer all the students' questions in time and effectively. This teaching method should be used in the appropriate courses. Bisection classroom and flipped classroom are both new teaching models in recent years. In the form of divided class, the class time is divided into two parts, one is left to the teacher for teaching, the other is left to the students for discussion. In essence, an internal link of psychology is introduced between teaching and discussion. After students absorb the teaching content, they are prepared to participate in the discussion, integrate the teaching method and discussion method, completely break through the traditional teaching mode, and significantly reduce the mechanization of teachers. Teaching burden enables critical thinking, creative thinking, communication and cooperation ability to be implemented in every class of daily teaching. Flipped classroom and bisector classroom have positive effects on improving classroom efficiency, they have something in common in the roles of teachers and students and assessment methods, but they have obvious differences in teaching sequence and dependence on information technology. Teachers should adopt suitable teaching mode according to the situation of students and teaching content [11].



FIG. 2 HYBRID TEACHING REFORM OF HARBIN INSTITUTE OF TECHNOLOGY (WEIHAI)

6 CONCLUSIONS

In view of the existing teaching problems, based on the OBE concept, the classroom teaching reform is carried out for the vehicle specialty, from the formulation of curriculum teaching objectives to the formulation of teaching contents, the use of new teaching mode, the establishment of achievement oriented teaching framework and professional curriculum system, highlighting the application and practicability of learning, improving the fit between students and social needs and industry needs, and focusing on professional knowledge and professional skills. The simultaneous cultivation of innovation ability, practical ability, comprehensive professional quality and comprehensive professional ability. In recent years, the automobile industry is undergoing profound changes. In teaching, we should adhere to the development concept, connect the teaching with the new technology and concept of the industry, promote students to adapt to the new changes, and pay attention to the cultivation of students' innovation awareness and thinking ability, so as to cultivate the engineering and technical talents needed by the society.

ACKNOWLEDGMENT

This research was supported by Postgraduate Education and Teaching Reform Project of Harbin Institute of Technology (JGYJ-2019038), Postgraduate Education and Teaching Reform Project of Harbin Institute of Technology at Weihai (WH2019010), and Teaching Research Project of Harbin Institute of Technology at Weihai (BKQN201905).

REFERENCES

- [1] Jia JinFang, Wang Xiaoying, Liu Zhiqiang. Based on SPOC's C language flipped classroom teaching reform and exploration. *J. Computer education*, 2019, 1, 141-144
- [2] Yang Jun, Guo Yanyan. Computer foundation of University Spiral teaching design of basic courses. *J. Computer education*, 2019, 1, 55-58
- [3] Jiang Bo. OBE: results based education [J]. *Foreign education research*, 2003 (30): 35-37
- [4] Wang Lili, Chen Qingguang, Zhang Xin, Du Xiaozhen. Research on teaching reform of "Fundamentals of mechanical engineering control" based on OBE mode [J]. *Education and teaching forum*, 2019 (34): 100-102
- [5] Li Nana, Liu Jixuan, Xu Yongqiang. Reform and practice of mechanical production practice based on OBE concept [J]. *Education and teaching forum*, 2019 (24): 22-23
- [6] Wang Yinhao. Teaching reform of "Fundamentals of mechanical manufacturing technology" based on OBE concept [J]. *Occupation*, 2019 (09): 51-52
- [7] Wang Zhongjiao, Zhang Zeyun. Practical logic and practical choice of high-quality employment of application-oriented undergraduate graduates [J]. *Education and occupation*, 2019 (20): 75-81

- [8] Liang Jia. Research on the integration of entrepreneurship education and employment guidance in Colleges and universities [J]. *Curriculum education research*, 2019 (40): 17
- [9] Feng Guoguo. Analysis on the path of promoting the employment and Entrepreneurship of college graduates under the new normal [J]. *Modern marketing (Information Edition)*, 2019 (11): 68-69
- [10] Lu Qiang. Cold thinking of flipped Classroom: demonstration and reflection [J]. *Audio visual education research*, 2013 (8): 91-97
- [11] He Kekang. New progress in the theoretical research of educational informatization in China [J]. *China audio visual education*, 2011 (1): 1-19

AUTHORS



¹**Yiqun Liu**, born in 1988, is currently a Lecturer at School of Automotive Engineering, Harbin Institute of Technology at Weihai, China. He received his PhD degree at Harbin Institute of Technology, China, in 2016. His research interests include intelligent mobile robots, special vehicles, and

innovation education.



²**Xiaojing Zhou**, born in 1988, is currently a Lecturer at Finance Department, Harbin Institute of Technology at Weihai, China. She received her master's degree at Shandong University of Finance and Economics, China, in 2013. Her research interests

include financial management and innovation education.



³**Yanyun Chen**, born in 1997, is currently a college student at School of Automotive Engineering, Harbin Institute of Technology at Weihai, China. Her research interests include vehicle engineering and Outcomes-based Education practice.



⁴**Pengwei Dong**, born in 1998, is currently a college student at School of Automotive Engineering, Harbin Institute of Technology at Weihai, China. His research interests include vehicle engineering and innovation education practice.