

Study on the Reform of Talent Training Mode of Vehicle Engineering in Application-oriented Undergraduate Universities Based on OBE Concept

Taking the Vehicle Engineering Majors in Nantong Institute of Technology as an Example*

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Abstract—Outcome-based Education (OBE) is a kind of education-oriented concept based on learning output, which is the mainstream trend of current engineering education, especially suitable for the cultivation of application-oriented talents. Nantong Institute of Technology introduced the concept of OBE into the reform of talent training mode of vehicle engineering major, which played a positive role in cultivating students' knowledge, ability and quality. This article elaborate respectively from the professional training objectives and graduation requirements revision, the construction of professional curriculum system, the establishment of the overall structure of teaching organization design, teaching methods and education support system reform, quality control management, operation mechanism and other aspects.

Keywords—OBE; talent training; curriculum system; vehicle engineering; reform

I. INTRODUCTION

OBE is the abbreviation of Outcomes-Based Education. It is an educational concept Based on learning Outcomes. The concept was first proposed by American scholar William g. Spady, and has been widely valued and applied in the world, which is regarded as the right direction for the pursuit of excellent education. After years of theoretical research and practical exploration, some countries and regions have accumulated good experience, which proves that it is especially suitable for application-oriented talent training. Against the background of the national strategic planning "made in China 2025", to realize talent cultivation

*Fund Project: University philosophy and social science research fund project in Jiangsu province "Exploration and research on the cultivation of applied private undergraduate talents based on OBE — a case study of vehicle engineering" (Project number: 2018SJA1276); Educational and teaching reform research project of Nantong Institute of Technology "Online course of automobile construction based on green concept (Project number: 2017NITJG03).

in engineering majors of application-oriented universities is in line with national strategy, the OBE model has good reference significance.

At present, the discipline orientation is generally adopted in the training of vehicle engineering professionals in some application-oriented universities. The traditional training process is rigid, and students' application ability, practical ability and innovation ability cannot meet the needs of enterprises. As an application-oriented private undergraduate university, Nantong Institute of Technology undertakes the important task of cultivating high-quality and application-oriented talents for regional economy. By introducing the concept of OBE education and combining with the requirements of China's engineering education certification, the vehicle engineering major in Nantong Institute of Technology has improved its talent training mode and achieved certain results. The following aspects of reform research have been carried out in specific.

II. BEING CLEAR ABOUT THE OBE CONCEPT AND DOING A GOOD JOB IN THE TOP-LEVEL DESIGN

The focus of OBE education reform is how to change from discipline-oriented to goal-oriented, that is, from teacher-centered to student-centered. As shown in "Fig. 1", the core of the OBE education concept lies in the reverse establishment of teaching process based on the output orientation. Firstly based on the requirements of regional economic development, the characteristics of school talent training and the expectations of various stakeholders, educators should study the expected results of students' professional learning, establish the talent training objectives of the major, formulate graduation requirements, and inversely deduce the requirements in terms of knowledge, ability and quality to meet the objectives and requirements, and carry out index points elaboration and decomposition. Then, they are supposed to analyze how to organize and

allocate teachers, courses and other teaching resources to plan and organize the curriculum system, formulate the syllabus and implement the curriculum in order to meet the requirements; how to carry out teaching evaluation to realize

constant adjustment of each index point and drive continuous improvement through inter-course circulation, inter-college circulation and off-school circulation so as to complete the top-level design.

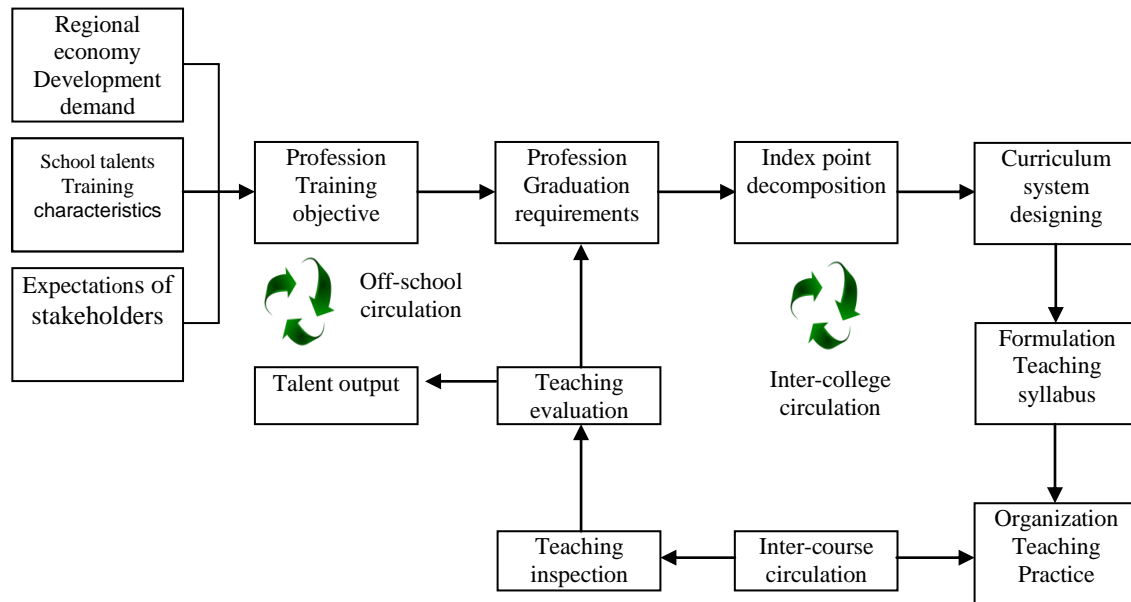


Fig. 1. Design of outcome-oriented teaching process.

III. REVISING PROFESSIONAL TRAINING OBJECTIVES AND GRADUATION REQUIREMENTS

Before the revision of the talent training plan, the school organized several learning activities to deeply understand the concept of OBE. A research team led by the leaders of the college, professional leaders, director of the teaching and research office and attended by the professional teachers was set up to carry out investigation on the employment enterprises, industries and posts of students. By holding school-enterprise-industry symposiums, the research team listened to the opinions of the enterprise and industry experts; deeply analyzed the demands for and key elements of applied talents of vehicle engineering major at undergraduate level of the social development of Nantong city and the Yangtze river delta economic region as well as the knowledge, ability and quality that students are supposed to master; and grasped the development trend of related industries in the area. At the same time, closely in line with the school's talent training positioning, following the school "Notice on the revision of undergraduate professional talent training program", the team extracted the talent training objectives that could reflect the characteristics of application-oriented undergraduate of vehicle engineering majors.

The team further clarified the rationality of the training objectives, and gave full consideration to the professional and professional achievements of students majoring in vehicle engineering five years after graduation to define the graduation requirements, detail and decompose the graduation requirements index points, so as to establish the corresponding relationship between the graduation requirements and the training objectives. On the basis of

analyzing the demand of the society and the industry for the post ability, they explained the graduation requirements of the students from the aspects of knowledge, ability and quality. Graduation credits are specified in detail in four parts: course credits, credits for the second class, credits for discipline competition and credits for innovation and entrepreneurship education. At the same time, corresponding specific provisions have also been formulated in the acquisition of professional certificates.

IV. BUILDING AN OUTCOME-ORIENTED PROFESSIONAL CURRICULUM SYSTEM

According to the corresponding relationship between professional talent training objectives and graduation requirements, and in accordance with the concept of OBE results-oriented, Nantong Institute of Technology emphasized on the training of students' comprehensive ability of solving engineering problems. When building the system, they emphasized the following aspects:

A. Highlighting Applications to Enhance the Integrating Degree Between Students and the Demands

Starting from the purpose of cultivating high-quality application-oriented talents, based on the student pool of the vehicle engineering major in Nantong Institute of Technology, the school optimized the professional knowledge, strengthened the professional ability, and internalized humanistic and scientific qualities to improve the overall curriculum system. They put emphasis on the practical teaching process and add subject competition credits to integrate subject competition into course teaching and assessment so as to highlight the applicability. They

effectively implemented the student-centered educational concept to increase the degree of agreement to meet the needs of regional economic and social development.

B. Adhering to the Concept of Development to Promote Students to Adapt to New Changes

In recent years, the automobile industry is undergoing significant changes. New technologies and products represented by new energy vehicles have developed rapidly and gained popularity rapidly. National automobile enterprises have grown stronger, and market competition has intensified. With the rapid development of automobile industry, the demand for talents is huge, and the diversification of talent structure is also required. Therefore in the construction of curriculum, the school actively connected with the technological progress of the industry and promoted the update of teaching content in line with the latest development of the discipline, industry and technology, so as to make good preparation for the cultivation of talents needed in the future.

C. Integrating Innovation and Entrepreneurship Education into the Whole Process of Talent Cultivation

Pay attention to the cultivation of students' innovative and entrepreneurial consciousness, thinking and ability. By offering innovation and entrepreneurship general courses and innovation and entrepreneurship courses with specialty characteristics, the school included students' extracurricular activities such as scientific and technological innovation, discipline competition, entrepreneurship training and social practice in their graduation credits, so as to form a progressive, organic innovation and entrepreneurship education curriculum system integrated with professional training.

Talent cultivation specification matrix is an effective means to effectively connect the professional talent cultivation objective and curriculum objective, which makes the talent cultivation plan and curriculum objective measurable and operable. Through the establishment of vehicle engineering professional training specifications matrix, from the three first grade indexes of knowledge, ability and quality, 16 secondary indicators and 68 three-grade indicators were decomposed, and the specific way to achieve has also been described. The revised curriculum system consists of general education module, professional education module, centralized practice module and innovation and entrepreneurship education module. General education modules include ideological and political education courses, college foreign language courses, information technology courses, college students' physical and mental health and safety courses, writing and communication courses and general education elective courses; Professional education modules mainly include professional basic courses, professional courses, professional direction courses and professional elective courses; The centralized practice module sets up the centralized practice link according to the characteristics of vehicle engineering major; The innovation and entrepreneurship education module includes innovation and entrepreneurship courses,

innovation and entrepreneurship credits and the second classroom, in which the credits for innovation and entrepreneurship and credits for the second classroom are implemented in accordance with the university's "credit recognition measures for innovation and entrepreneurship practice" and "corresponding credit recognition measures for transcript of the second classroom", which were not included in the total credits for talent cultivation programs as graduation requirement.

In order to ensure that the professional curriculum system play a positive role in the realization of talent training objectives and promote the continuous improvement of the curriculum system, the school has formulated the principle of "revision every four years" of talent training program. A working group on talent training program revision led by the President and the vice President in charge of teaching, attended by professional principals, directors of the teaching and research office, teachers, industry experts and enterprise experts were set up to revise the talent training program and curriculum system.

V. ESTABLISHING AN OUTCOME-ORIENTED TEACHING ORGANIZATION DESIGN FRAMEWORK

According to the OBE concept, it is emphasized that students should be the center and the academic output should be the orientation. Through the determining of the teaching process in reverse and implementing it in a positive way, can the students become the masters of learning, thus effectively improving the quality of education and teaching. The overall structure of the teaching organization design is as follows:

- 1) Through the analysis of the training objectives and graduation requirements of vehicle engineering professionals, determining the nature of the curriculum, and composing the curriculum syllabus with the understanding of the relationship between the curriculum and graduation requirements;
- 2) determining the teaching objectives and teaching requirements of the course according to the corresponding situation;
- 3) decomposing the specific teaching contents of the course, as well as the teaching objectives, key points and difficulties of each teaching content, as well as the solutions corresponding to the teaching objectives of the course;
- 4) highlighting the cultivation of students' application ability through the design of in-class practice;
- 5) determining the evaluation basis of courses, and designing specific assessment methods, weights and requirements;
- 6) standardizing the preparation process and implementation process of class, and paying attention to the reasonable use of teaching methods;
- 7) strengthening the evaluation and monitoring of the course teaching process and teaching effect, so as to constantly improve the course teaching, and improving the degree of achievement of talent training objectives and graduation requirements.

VI. PROMOTING THE REFORM OF TEACHING METHODS AND EDUCATION SUPPORT SYSTEM

A. Reform of Professional Courses Education

1) *Fitting the demand and integrating the teaching content:* On the basis of the preciseness and logicity of the course structure, the integration of various courses has been strengthened to avoid the repetition of different courses in the teaching content. With an eye to student development, while fully considering the student source of the vehicle engineering majors, the school integrated and decomposed the typical tasks in the work position and then infused them into the classroom teaching content of each course, focusing on the multi-disciplinary and multi-perspective problem solving course.

2) *Highlighting application and enhancing ability:* The school has made overall arrangements for experiments, practical training and various practical teaching links. Course teaching has been arranged in the first ten weeks of the seventh semester so that the time in later weeks could all be used for production practice (social research), graduation practice, graduation design (thesis) and defense. This has not only facilitated the implementation plan of trinity including graduation practice (production practice), graduation design (thesis), students pre-employment program, but also facilitated the setting of more graduation design (thesis) topic from the production, management line and arrangement of docking guidance of enterprise guidance teacher, to achieve the purpose of real-field practice.

3) *Strengthening individualized training:* On the basis of setting up professional courses, the school set up more elective courses (in addition to elective courses in professional direction) to improve students' independent choice space and promote the diversification of talent cultivation.

B. Reform of Teaching Methods

The concept of OBE is student-centered, with special emphasis on students' academic gains, the output of teaching process and individualized and research-oriented teaching. It requires teachers to fully understand each student, make full use of various teaching methods and means, and develop different teaching programs to improve students' learning gains.

1) *Reform of theoretical teaching methods:* The traditional "indoctrination" classroom teaching has been changed. The school guided students to participate actively and think positively through group discussion, debate, keynote speech, teachers and students roles exchange and other forms. At the same time, the thinking, methods and latest progress of scientific research have been introduced into classroom teaching to broaden students' horizons and cultivate their innovative thinking.

2) *Reform of practical teaching mode:* Efforts have been made to reduce demonstrative and confirmatory

experiments and to arrange more comprehensive, innovative and designing practical link. Guided by engineering cases, progressive experiments were carried out to enable students to independently choose experimental schemes and carry out experimental operations in the process of inquiry, so as to stimulate students' learning enthusiasm and cultivate their scientific research and innovative thinking.

3) *Extracurricular practice activities:* A variety of extracurricular interest groups and studios related to the major have been set up to facilitate students to carry out practical activities related to the major in their spare time. By visiting enterprises, participating in professional competitions, organizing social surveys and other ways, students have cultivated their scientific and innovative thinking and improved their practical and innovative ability.

C. Reform of Education Support Carrier

1) *The construction of "double-qualified" teachers:* The concept of OBE holds that the quality of teachers is an important factor affecting the achievement of talent training objectives. For application-oriented universities, "double-qualified" teachers are particularly important. Nantong Institute of Technology has established a communication mechanism between school and enterprise talent, and continuously increased the proportion of "double-qualified" teachers through internal introduction and external training, so as to provide teacher guarantee for the cultivation of application-oriented talents.

2) *Reform of school-enterprise cooperation platform:* Cultivation platform has been established with the joint efforts of the school and enterprises. At the beginning, enterprises provided internship positions to universities, and universities provided technical support to enterprises; up to now a cooperative education mode of deep integration has been set up where innovation studios, laboratories, key laboratories and practice bases inside and outside the university have been co-built with enterprises fully involved in the education process. In this way can the school train the talents needed for the future development of vehicle engineering by the use of the company's platform today.

VII. OPTIMIZING THE QUALITY CONTROL MANAGEMENT SYSTEM TO IMPLEMENT THE "THREE CIRCULATIONS" AND PROMOTE CONTINUOUS IMPROVEMENT.

While the university has issued relevant rules and regulations on teaching management, the school has formulated and promulgated a series of detailed teaching management regulations to comprehensively monitor all links before, during and after teaching. The regular teaching inspection system has also been carried out to implement the system of supervision and attendance in class, and a system of professional teachers listening to each other in class. At the same time, student information officers in each class are arranged to regularly report the class operation to the college. The communication channel between teachers and class counselors has also been unblocked, so that problems could be timely improved.

Implementing the "three circulations" According to the principle of OBE reverse design, the inter-course circulation is mainly reflected in classroom teaching inspection, which checks the achievement of course teaching objectives by means of teachers' self-inspection, experts' lecture attendance, students' homework completion and students' participation in the course. Inter-college circulation focuses on the examination of course teaching evaluation and examining the contribution of the course to graduation requirements through the teaching supervision feedback, course assessment, grade distribution, etc. The off-school circulation refers to comprehensively examining the degree of graduation requirements of graduates through a survey conducted on enterprises and graduates, so as to provide a basis for the revision of talent training program and graduation requirements.

VIII. CONCLUSION

Breaking the traditional idea of talents training, the application-oriented talent training mode based on OBE is a scientific and reasonable educational idea. In the implementing process, students of vehicle engineering majors in Nantong Institute of Technology have systematically mastered professional theoretical knowledge and professional skills, acquired certain engineering practice ability and cultivated innovative thinking. They effectively improved professional quality, further improved social competitiveness, and won unanimous praise from enterprises.

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