

## Teaching Reform and Exploration of Chemical Engineering Design in Local Undergraduate Universities Under the Concept of OBE

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Abstract. Outcome Based Education has become the mainstream of educational reform in the United States, Britain, Canada and other countries, and has been fully adopted by the professional certification of engineering education. It is of practical significance to guide the reform of engineering education in China with the idea of Outcome Based Education. In the course of cultivating students majoring in chemical engineering and technology, the biggest characteristic is that they need to transfer from pure theory to engineering. But theoretical knowledge is very different from practical engineering, as if there exists a huge gap that needs to be crossed by a bridge. Through this bridge, students can skillfully use the theoretical knowledge they have mastered to solve practical engineering ability and innovation ability. Aimed at the problems existing in the teaching of chemical engineering design course, the teaching reform of chemical engineering design was discussed from the theory teaching, practice teaching, the computer application in chemical engineering design et al. Thus driving the local undergraduate colleges and universities to complete the application-oriented transformation.

#### 1. Introduction

Outcome Based Education, referred to as OBE, is also called ability oriented Education, goal oriented Education or demand oriented Education. As an advanced educational concept, it was put forward by Spady et al. in 1981 and soon gained people's attention and recognition. And has become the mainstream idea of education reform of the United States, Canada and other countries and has been fully adopted by engineering education certification. The American association for the certification of engineering education standards. In June 2013, China joined the Washington agreement and became a member of the agreement, which marked the beginning of the certification of engineering education substantive equivalent in China. Engineering education certification follows three basic principles: results-oriented, student-centered, and continuous improvement. These ideas are very important to guide and promote the professional construction and teaching reform, guarantee and improve the quality of engineering education personnel training. It is of practical significance to guide the reform of engineering education in China with the idea of OBE.

In order to meet the needs of economic and social development, solve structural contradictions of higher education, reverse the homogeneity tendency, alleviate the employment difficulties and low employment quality of graduates from local ordinary universities, train applied, compound and innovative talents who are in short supply in the front line of production and service, the Ministry of Education, the National Development and Reform Commission, Ministry of Finance launched guiding opinions on guiding some local undergraduate universities to transform into application-oriented ones in 2015. This not only conforms to the urgent needs of regional economic and social development, but also serves as the common mission and challenge of newly-established undergraduate colleges and universities, and is an inevitable choice for the development of colleges

and universities to reach a new level [1]. Application-oriented universities should take serving local economic and social development as their mission to promote the transformation of disciplines and majors. The goal is to enhance students' practical ability and social adaptability to promote the transformation of talent training mode. To change the goal of talent training by means of characteristic development and dislocation competition. Colleges and universities are composed of disciplines and majors, and the transformation should not be the transformation of schools, but the transformation of majors and disciplines. Disciplines and majors lead schools to complete the transformation into application-oriented ones [2].

In the course of cultivating students majoring in chemical engineering and technology, the biggest characteristic is that they need to transfer from pure theory to engineering. But theoretical knowledge is very different from practical engineering, as if there exists a huge gap that needs to be crossed by a bridge. Through this bridge, students can skillfully use the theoretical knowledge they have mastered to solve practical engineering problems. Chemical Engineering design is one of the core courses to cultivate students' engineering ability and innovation ability. It is helpful to cultivate the students' independent learning, independent thinking and ability to apply the knowledge to solve engineering problems through the course. It is a very important teaching link to improve students' comprehensive quality and to transform college students to the engineer [3,4].

The school of chemistry and chemical engineering of Zaozhuang university has made a series of explorations in the process of promoting the transformation of chemical engineering and technology specialty to application type undergraduate course by taking the opportunity of "chemical engineering and technology" as the experimental specialty of "excellent engineer education and training plan" of the ministry of education, and taking advantage of the driving role of chemical engineering design curriculum.

#### 2. Concrete Measures

# **2.1** Based on the principle of "application ability orientation", the combination of design examples and theories is emphasized in theoretical teaching

The training of modern engineers should adopt the training mode of "combining knowledge with practice, and combining dual core". Therefore, teachers should make clear what professional abilities are mainly cultivated in the course and how to implement the teaching, and construct the knowledge framework and knowledge points accordingly [5]. The course of chemical engineering design is obviously different from other theoretical courses in that it emphasizes the practicality and engineering of the course. Therefore, teachers often design teaching plans from the perspective of practical engineering design. Case analysis and practice of designing examples are a good way to improve teaching quality. The reform of chemical engineering design teaching content should adhere to the principle of "application ability-oriented" : that is, the curriculum should be reorganized and optimized to cultivate students' application ability, and strengthen the component of ability items in knowledge points in the curriculum system. The theoretical teaching of chemical design mainly teaches the basic knowledge and basic procedures of chemical process design, including process design, material and energy balance, equipment selection and calculation, and workshop layout design. It's main teaching purpose is to make students master the basic concepts of chemical design and the basic procedures of chemical plant design. According to the application and comprehensive characteristics of chemical engineering design course and the principle of "application ability orientation", the theoretical teaching should be changed from the previous pure theoretical teaching mode, and design examples should be introduced. Pay attention to the teaching method combining design examples with theoretical knowledge, start from design examples, carry out discussions in class and after class, so that students consolidate and deepen the knowledge learned in class, make themselves truly involved in the design process, enhance the ability of practical application, and fully stimulate students' interest in learning. Through the comprehensive use of "heuristic, discussion,

research, case" and other teaching methods, teaching content focus on the application and timeliness, teaching methods focus on the comprehensive application of knowledge.

### 2.2 Increase the proportion of practice teaching and increase the practice teaching link

The training goal of chemical engineering and technology of Zaozhuang university is training applied talents with high quality who satisfy the needs of the socialist construction in our country, who is fully developed morally, intellectually and physically, with solid basic knowledge of chemical engineering and technology, with good scientific quality and innovative spirit, meeting the need of regional economic and social development, with high engineering practice ability, and working in the chemical engineering and technology and related fields. Students' ability to solve practical engineering problems must be cultivated through practice.

Through further increasing the practical teaching proportion of chemical engineering design, students can learn to use the most advanced design software for chemical engineering design, laying a foundation for engineering design after graduation. First of all, the number of studying hours for computer training will be increased by 30 hours. Secondly, through the form of course design, students are organized to carry out a four-weeks preliminary design of chemical engineering projects, so that students can truly understand the steps of chemical engineering design, master the channels of information sources, and experience the role played by engineers in the whole process of design. Third, we will encourage students to participate in national college students' chemical design competition, and provide teachers with professional platform for the communication of knowledge and teaching methods; students can improve their professional knowledge level and engineering consciousness through the series design content of preparation, defense and other process, which has very important practical significance to cultivate their teamwork spirit and innovation consciousness.

#### 2.3 Attach importance to the application of computer in chemical engineering design

At present, process integration, process optimization, online database, 3d CAD, project collaboration management, electronic document exchange and other information technologies have been gradually adopted by the first-class chemical design institutes. Chemical engineering design has become an application-oriented course that integrates knowledge of chemical process, computer technology and engineering design, and emphasizes the cultivation of modern engineering design ability [6].

The modern chemical engineering design are inseparable from the computer including the prediction of material properties of molecular structure, the design of process flow, the selection of equipment and the layout of pipelines. Although the popularity of computers on campus is very high, the application of computers in chemical design, is very limited. To change the present situation, on the one hand, young teachers should be encouraged to study in this field; At the same time, appropriate class should be arranged to introduce relevant software to arouse students' interest in software application. If class hours is allowed, we will open some targeted computer application courses, such as Matlab, so that students have more opportunities to master the application of these software. These chemical design software has powerful functions and high working efficiency. Through introduction and demonstration, students can not only broaden their horizon, increase their knowledge, but also stimulate their interest in learning and improve their learning initiative.

# 2.4 Through the chemical simulation experiment training, improve the students' practical ability

Chemical engineering design is a course closely related to the practice of chemical plants. The teaching process should be related to the actual operation so as to improve the teaching level. Generally, the computer simulation teaching system needs to set up basic operating units, which are accompanied by the operating principle of each operating unit and a simple process flow introduction, as well as the process flow chart with control points, the Distributed control system (DCS), the field diagram, and operational considerations [7]. In order to improve the quality of professional practice teaching of chemical engineering and technology, using the campus chlor-alkali industry process control in the joint demonstration platform, annual output of 300000 tons of ethylene production equipment, simulation of synthetic ammonia process, methanol process simulation, coal-water slurry



pressurized gasification process simulation et al. The theory knowledge and the technological process learned from the common textbooks are shown to students through real equipment and workshop. Students' pursuit of engineering knowledge will be changed from a passive state to an active state, which will be obviously reflected in students' engineering design and graduation design.

### 3. Summary

At present, the disadvantages of the traditional teaching mode have been obvious, which is not conducive to the cultivation of students' comprehensive quality and the improvement of their innovation ability under the new situation. The goal of the teaching reform of chemical engineering design course should be serving the local, combining with the local industry, and advancing with the times. The new technology, new knowledge, new process and new method of actual enterprise are integrated into teaching in time. The training of students' comprehensive ability is completed at the same time in the cultivation of students' ability of autonomous learning and independent innovation. Finally, we can train talents for the local enterprises, and take this opportunity to drive the local undergraduate colleges and universities to complete the transition to application.

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