

# ***Reform Practice of Engineering Drawing Courses in Chinese Colleges by the Blended Teaching Method with Different Teaching Modes and Resources Based on the XuetangX MOOC Platform***

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**Abstract**—Characteristics and of engineering drawing courses in Chinese colleges was introduced firstly, and the OBE Teaching mode for the reform of engineering education were represented and the reform practice of engineering drawing courses was introduced. Moreover, the traditional teaching mode and evaluation system were represented. Furthermore, the online class construction and the reform practice of engineering drawing courses was introduced, and the online learning resources and online test resources were listed. In the end, according to the whole contents of engineering drawing courses, the detailed reform practice for the mixed teaching mode by different teaching methods and online test resources were listed as a table. It is a important exploration for the drawing courses to carry out the reform practice on the base of the booming informatization and digitization teaching tools.

**Keywords**—Engineering drawing courses; OBE; Reform practice; Blended teaching mode

## I. INTRODUCTION

The Engineering drawing courses are foundation courses for corresponding major or subject, and it is an important technical foundation course for students studying in colleges of science and engineering, especially for the students whose major is mechanical engineering or similar major. This courses aims at cultivating the drawing ability and the ability of reading the engineering drawings. Therefore, the drawing courses are compulsory in Chinese colleges of science and engineering, and the class hour is between 60 hours and 90 hours and its credit is between 3.5 and 5.5. Teaching mode of drawing courses include classroom teaching, homework practice, exercises tutorials and drawing practice. General speaking, the number of students is not greater than 60 and this course will be taught two times a week.

## II. REFORM PRACTICE OF TEACHING MODE ON THE DRAWING COURSES IN CHINESE COLLEGES

### A. Problems Existed in the Traditional Teaching Mode of Drawing Courses in Chinese Colleges

In traditional teaching mode, the process of teaching and studying always revolve around the teaching program, and the teaching contents are restricted by the teaching program and corresponding knowledge points. During the whole activity of teaching and studying, the participation degree of students and the flexibility of teaching schedule are all low. After the courses have been finished, some students don't know how to choose suitable drawing methods to express the complex engineering parts reasonably and flexibly. Moreover, some students don't recognize the importance of national standard of China and corresponding industry standard, and there are lots of common mistakes in their drawings which can't reach the requirements of engineering application.

### B. Problems Existed in Performance Evaluation System of Drawing Courses

In traditional test mode, the examination paper are totally focused on the test of some single knowledge points, and it pay less attention to the engineering application and engineering practice.

Moreover, the part drawing and assembly drawing are most important contents in drawing courses, and they are also key test criterion to check and evaluate the learning outcomes and ability of engineering application. However, the test of these two contents is easy, and its complexity is not enough to reach the requirements of engineering application.

In addition, some common parts and standard parts are difficult to examine by closed-book test mode since it is not allowed to search for some parameter by the book.

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### III. REQUIREMENTS FOR THE REFORM OF DRAWING COURSES BASED ON THE OBE ENGINEERING EDUCATION MODE

Outcomes-based Education mode originated from the reform of basic education in United States and Australia. Originally speaking, OBE model spread around the mail line as “define outcomes-realize outcomes-evaluate outcomes”, and the evaluation of outcomes from the students’ studying is the ultimate aim to realize the continuous improvement of teaching effect. Researcher Richard from United States presented a design model of courses based OBE mode, and the performance evaluation of students’ studying was one of three important factor of this mode [1, 2].

In the OBE mode, the education aim is prior to the teaching contents, and teachers can set up teaching unit by themselves without the rigid restriction of the teaching program. It is very important for teachers to predict and evaluate the outcomes of students’ studying in this mode [3, 4].

### IV. REFORM PRACTICE OF DRAWING COURSES IN YANSHAN UNIVERSITY

Several years ago, the CDIO and OBE mode have been expanded in the College of Mechanical Engineering of Yanshan university for the education reform, and the team project and discussing class project have been added in all the profession courses. Moreover, PowerPoint presentation for the project and discussing class have already been a regular part of profession courses. Drawing department of college of mechanical engineering has carried out the reform of drawing courses since 2012, and the blue print of reform has been determined in 2016 by several years’ reform practice.

In recent years, online class have been endorsed as a major advancement of higher education and it provide sufficient learning resources and more learning choices for students [5].

In order to explore a new teaching mode for higher engineering education and promote the reform of higher education, Yanshan University Dean funded 4 main courses more than 300,000 yuan to construct online courses based on the Chinese MOOC Platform-XuetangX in June 2016 [6, 7]. Necessary resources such as teaching videos and PPT, online test questions for every chapter, questions of third-grade project and several subjective questions have been uploaded, and this online class had started to run since March 2018 as shown as in Fig.1. Until now, this online class have been running four times as shown in Fig.2.

At present there are more than 1200 students required to learn the course “Fundamentals of Engineering Drawing” every year, who are from 42 classes belonged to four different schools like Electrical School and Information Engineering School, Environmental Engineering School and Chemical Engineering School in Yanshan University.

Accessible digital resources are play a key role of online open courses, and it provides important teaching videos for students to visit at any time and learn anything they are interested in after logging in MOOC platform. In addition, students can make full use of fragmented time to complete the online preview and review by replaying the teaching videos.



Fig. 1. Class reports in XuetangX MOOC Platform



Fig. 2. Class Website in XuetangX MOOC Platform

As shown in Fig.3, the accessible learning resources includes teaching videos, online test after class, online mock examination after class is finished, rules and questions for third-grade project etc.



Fig. 3. Resources of online class in XuetangX platform

### V. REFORM SCHEDULE OF ENGINEERING GRAPHICS BY MIXED TEACHING MODES BASED ON MULTIPLE TEACHING METHODS

For taking full advantage of the classroom teaching mode and digital online class learn resources, the conception of mixed teaching mode was proposed different teaching modes, such as heuristic teaching, interactive teaching ,case teaching and teaching modes based on the application questions and engineering practice, were applied in the teaching process

according to different contents. Moreover, the evaluation resources, such as online test questions for every chapter, the mock examination after the class is over, rules and questions of

third-grade project and subjective questions were optimized its use. The detailed reform schedule was shown in Table I.

TABLE I. REFORM SCHEDULE OF ENGINEERING GRAPHICS BASED ON MULTIPLE TEACHING MODES

Week	Contents of the class	Teaching Mode	Teaching Schedule	Learning Output Evaluation of Different stage
1~4	Introduction	Heuristic teaching, Interactive teaching and Case teaching	Online preview, Teaching in classroom, Online discussing and answering questions	Random Quiz in class, Chapter test in class and Online test
	Projection of a straight line			
	Projection of a plane	Heuristic teaching, Interactive teaching and Case teaching	Self-study after class	Random Quiz in class, Chapter test in class and Online test
	Projection of plane stereoscopic and its cross-cutting line		Online preview, Teaching in classroom, Online discussing and answering questions	
	Projection of curved solid and its cross-cutting line	Heuristic teaching, Interactive teaching and Case teaching	Self-study after class	Random Quiz in class, Chapter test in class and Online test
	Intersecting line		Online preview, Teaching in classroom, Online discussing and answering questions	
	Improving the teaching result in time	According to the learning output evaluation of different stages, enhancing and strengthening the weak link existed in the learning process of students		
5~6	Drawing the view of a part	Teaching modes based on the questions and engineering practice	Online preview, Teaching in classroom, Online discussing and answering questions	Random Quiz in class, Chapter test in class and Online test after class
	Reading the view of a part		Online preview, Teaching in classroom, Online discussing and answering questions	
	Marking dimensions		Self-study after class	
	Drawing practice 1	Teaching mode based on the Interactive communication and engineering practice	Teaching in classroom, discussing and answering questions face to face	Teacher check the drawings and correct the drawing error and mistakes during The drawing process
	Improving the teaching result in time	According to the learning output evaluation of different stages, enhancing and strengthening the weak link existed in the learning process of students		
7~9	Conception of view and sectional view	Teaching modes based on the application questions and engineering practice	Online preview, Teaching in classroom	Random Quiz in class, Chapter test in class and Online test after class and online discussion
	Representation of different sectional views		Online preview, Teaching in classroom, Online discussing	
	Cross-section view and Simplified drawing methods		Self-study after class	
	Comprehensive practice		Teaching in classroom, Online discussing and answering question	
	Drawing practice2	Teaching mode based on the Interactive communication and engineering practice	Teaching in classroom, discussing and answering questions face to face	Teacher check the drawings and correct the drawing error and mistakes during The drawing process
	Third grade project: Flexible application of representation methods of drawing a part	Teaching modes based on the application questions and engineering practice and comparative discussion	Teaching in classroom, discussing and answering questions face to face	Students are divided into several groups to discuss the drawing idea and finish the part representation, and encourage students to take different drawing plan.
	Improving the teaching result in time	According to the learning output evaluation of different stages, enhancing and strengthening the weak link existed in the learning process of students		
10	Introduction of standards, parts and assembly	Heuristic teaching, Interactive teaching and Case teaching		Students show the drawing achievements and share their idea by the unit of a group, and evaluate each other.
	Representation of third-grade project	Teaching mode based on the Interactive communication and engineering practice	discussing and answering questions face to face	

## VI. CONCLUSION

For the cartography courses in China, the traditional teaching mode has problems such as low participation and low teaching flexibility in the teaching process, which makes the students' self-drawing ability poor, and the drawing norm and the basic knowledge of drawing are weak. The emergence of the MOOC platform provides a very good carrier and implementation platform for the reform of the OBE higher engineering education model. Yanshan University began teaching reform of mechanical drawing courses from around 2012. In 2016 all mechanical drawing courses implemented project-based teaching reform and assessment reform based on CDIO and OBE higher engineering education models. The online MOOC platform develops online learning engagement models for a variety of online learning parameters, and develops online learning output test systems for a variety of questions, including discussion sessions and three-level projects. Set reasonable online three-level projects and discussion topics, provide important basis and data support for teachers to supervise and intervene students' online learning and achieve continuous improvement of the curriculum.

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## REFERENCES

- [1] G. Veletsianos, A. Collier, and E. Schneider, Digging deeper into learners experience in MOOCs: Participation in-social networks outside of MOOCs, note-taking, and contexts surrounding content consumption. *British Journal of Educational Technology*. 46(2015), pp. 570-587.
- [2] Y. Wang, and R. Baker, Content or platform: Why do students complete MOOCs. *MERLOT Journal of Online Learning and Teaching*. 11(2015), pp. 17-30.
- [3] S. White, H. Davis, K.P. Dickens, M. Leon, and M. Sanchez Vera, MOOCs: What motivates producers and participants. *Proceedings of the 6th international conference on computer supported education*. Heidelberg, DE: Springer. (2015), pp. 99-114.
- [4] R. Fontana, C. Milligan, A. Littlejohn, and A. Margaryan, Measuring self-regulated learning in the workplace. *International Journal of Training and Development*. 19(2015), pp. 32-52.
- [5] K. Jordan, Initial trends in enrolment and completion of massive open online courses. *The International Review of Research in Open and Distributed Learning*. 15(2014), pp. 133-160.
- [6] Y.G. Dong, J.F. Song, H. Zhu, G.L. Luo, Exploration of teaching reform of drawing courses in Chinese colleges and universities based on the advanced engineering education model. 2017 2nd International conference on Humanities and social science (HSS2017), Shenzhen, China. *Advances in social Sciences, education and humanities research*, 83(2017), pp. 34-38. (In Chinese).
- [7] Y.G. Dong, J.F. Song, Reform practice of evaluation method of drawing courses in Chinese colleges adapting to advanced manufacturing technology. 1st International conference on education, Management, Science and Economics (ICEMSE2016), December 26-28, 2016, Singapore. *Advances in Social Science, Education and Humanities*, 65(2016), pp. 379-381. (In Chinese).