

Reform and Practice of the Engineering Drawing Course Based on OBE Concept

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Abstract—Engineering drawing course is a basic course of non-mechanical specialty. This course plays an important role in cultivating students' engineering and innovation ability. According to the concept of OBE, the course not only introduces the concept of result-oriented but also permeates the concept of engineering design into teaching. The course constructs the teaching system of "General Public Module + Professional Theory Module". Our auxiliary instruction integrates drawing software, modeling software, multimedia technology, physical model. The appropriate knowledge points are selected for project-based, case-based teaching. It not only improves the teaching and assessment methods, but also optimizes the overall content of the engineering drawing course. Through the improvement of the teaching method, the students independent learning and innovation ability are effectively improved, and the teaching effect is also enhanced. The results showed that the average score of students in the same major increased by 1 point, and the failure rate decreased from 6% to about 4%.

Keywords—Engineering Drawing Course; OBE; Curriculum Revolution; Autonomic Learning

I. INTRODUCTION

The educational model based on learning output, result-oriented education (Outcomes-based Education, OBE), first appeared in the basic education reform in the United States and Australia. OBE teaching concept focuses on students themselves, highlights students learning results, and attaches importance to the educational ideas and methods of how students can obtain the expected learning results after curriculum learning. It centers on the goal of learning results that students expect to achieve after the end of the course, and then designs teaching schemes around this goal in the teaching process, implements teaching and evaluates the results of teaching. OBE teaching concept clearly focuses on all links of teaching, rich and diverse teaching activities make students achieve learning goals step by step in the learning process, and finally achieve the expected learning results.[1-2]Engineering drawing course is a basic course of non-mechanical specialty, general knowledge course in our university. Students can cover a wide range of subjects, involving electricity, management, economics, science, law, art and other disciplines, is an important technical tool to realize "mass innovation, mass entrepreneurship". The course mainly trains students spatial imagination ability, spatial configuration ability, logical thinking, creative thinking ability, graphic expression ability

and visual expression ability, and trains students graphic thinking ability. Through this course, students have the most basic understanding of modern engineering design and manufacturing. At present, most of the engineering drawing teaching adopts a unified syllabus. Not only does it not take into account the needs of different professions, but also pays attention to the assessment of the final results. At the same time, it does not pay attention to the assessment of the process and ability. The teacher's teaching is the main body, and there is no student-centered teaching. There are certain problems in the teaching of the course. In order to make the teaching meet the needs of OBE concept and professional development, it is necessary to reform the teaching objectives of engineering drawing course according to the objectives, evaluation methods and certification standards of OBE, based on the professional requirements and ability training.

II. THE ESTABLISHMENT OF TEACHING METHOD AND TEACHING SYSTEM WITH OBE AS THE GOAL

First of all, the teaching method of engineering drawing course should pay attention to the final learning effect of students, take OBE idea as the guiding ideology to meet the requirements of professional training goal, so that students can initially form the ability to solve simple engineering problems, so the whole course system and teaching content should be constructed with the purpose of "application". Teachers should integrate and optimize the curriculum content according to the set teaching objectives and expected learning results. On the basis of taking into account the basic knowledge of projection theory, ruler drawing, drawing specification, pattern expression, size and technical requirements, and core knowledge in the course of Engineering drawing, the theoretical content of drawing is deleted, the teaching of computer drawing content is strengthened, and the teaching of basic knowledge of unarmed drawing and surveying and mapping is increased. According to the professional training goal, the teacher corresponds the knowledge point to the professional requirement, and makes use of the real engineering case to carry on the teaching. Combined with the level of running a school and the characteristics of running a school, this paper probes into the reform of the curriculum system, the teaching methods and means, the topic selection and compilation of exercises, and tries to improve the students comprehensive application ability, such as the ability of unarmed sketches, the ability of configuration of the body, the ability of expressing pattern, etc. with emphasis on introducing heuristic and guiding teaching

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ideas, strengthening the cultivation of students graphic thinking ability and applied learning ability. It not only takes into account the basic knowledge, the teaching of classical knowledge, but also has some innovation, and has certain characteristics, which can better meet the current teaching needs.

Secondly, teachers need to combine theory with practice and establish a curriculum system guided by "solving simple engineering problems". Strengthen students team cooperation ability, guide the team to find and solve problems autonomous learning ability, gradually integrate freehand drawing and computer drawing, combine into the practice link, stimulate students interest in learning and learning potential. Teachers should use online and offline mixed teaching to introduce knowledge points and their applications, and cultivate students ability to use what they have learned to solve simple practical engineering problems, so that students can apply what they have learned, improve students interest in learning and achieve the ultimate teaching goal, which is also the core of OBE concept.^[3]

III. MAIN TEACHING METHODS OF THE ENGINEERING DRAWING COURSE

A. Constructing the Teaching system of "General Public Module + Professional Theory Module"

In the part of "General Public Module" and "Professional Theory Module", heuristic teaching is adhered to, and students autonomous learning is advocated by using the task-driven method, project teaching method, case teaching method, situational teaching method and so on. The general common module takes the basic principle as the core, mainly including the commonly used geometric drawing method is mastered. General drawing tools and instruments are used correctly. The basic theory, method and application of positive projection are mastered. The points, lines and intersecting lines between plane and solid on the surface of stereoscopic projection body are mastered, and the intersecting line drawing method of intersecting two rotating bodies is mastered. The combination view drawing method and dimension marking, read the combination view is mastered. The relevant provisions of the national standards for mechanical drawing are mastered. The content and function of part drawing, assembly drawing and so on are understood. Through it, the public foundation is focused on. The "Professional Theory Module" emphasizes that according to different majors to absorb the corresponding professional theoretical knowledge, to combine different specialties with different cases, such as electrical product parts diagram and other related knowledge, to improve the interesting point of students learning. In the introduction class, through a simple mechanical device, from the content of assembly drawing to the drawing of parts, and then to the drawing of three views of the combination to make a systematic introduction, the introduction of positive projection method is added, so that students can systematically understand the teaching links and cultivate students independent observation and image thinking ability.^[4]

B. Discussion method and the self-study method.

By discussing in class to stimulate students initiative in learning, students subject position in teaching is embodied. Some classroom discussions are intentionally arranged to allow students to participate fully in teaching and explain their own viewpoints. Finally, teachers and students discuss and sum up together to get the optimal answer; more multi-solution problems are used, especially those suitable for classroom discussion interaction and enlightening thinking. In addition, it is necessary to reserve after-class content, students are required to self-study, try to solve problems on their own, and then teachers are explaining and answering, cultivate students to learn to collect information independently, autonomous learning ability. Teachers summarize the content of self-study in the form of classroom discussion in order to cultivate students communication and autonomous learning ability.

C. Combining Theory with practice and introducing Engineering case Teaching

Select the relevant engineering example drawings, promote the teaching with the case, and select the case, in order to consider the purpose and requirements of the teaching, we must focus on it. At the same time, the domestic and foreign drawings are compared and taught, and the similarities and differences are analyzed. Through the collection and citation of engineering examples, it is not only helpful for teachers to combine theory with production practice and improve teaching quality, but also for students to understand the frontiers of subjects in time, to understand the new developments of the industry and to enhance students engineering practice ability.

D. The practical application of three-dimensional modeling in teaching

The introduction of 3D modeling software into the course teaching of engineering drawing can well assist students in understanding the course, understand the teaching content more thoroughly and improve the teaching efficiency. For example, when explaining the intersecting line and intersecting line, using the cutting function of 3D software, the parts can be removed in any plane position to form the false section plane, and the intersection point formed by the false cross-section interception model can be seen more intuitively. It is easier for students to understand the intersecting line and the related content of the intersecting line. When explaining the combination, using three-dimensional CAD software to add different colors to the different surfaces of the model, combined with the four-view function of the viewport and the feature hiding function, each part can be displayed and superimposed step by step, and through hands-on modeling, the method can be vividly understood and the teaching efficiency can be improved, which can also attract the attention of students in classroom learning. When explaining the section view or section view, by using the cutting or section function of three-dimensional software, the part can be cut in any position, and the position parameters of the section plane can be modified dynamically, the profile obtained from different cutting positions can be compared, and different sections can be selected for cutting. After the teacher explains the

advantages and disadvantages of cutting in different cutting positions, better teaching effect can be achieved. ^[5]

E. Online and offline counseling answers

Because the engineering drawing course is the learning basis of the subsequent professional course, it requires the expression of projection theory and view, the knowledge structure such as part drawing and assembly drawing has certain integrity, and the teaching content can not be deleted too much because of the reduction of the total class time. Therefore, in order to teach the teaching content of the course in limited classroom time, it is necessary to reduce the time to explain the exercises. In order to solve this problem, the cartographic course has a fixed answer time every week, but there are still many students who can not answer questions because of various questions, which affects the learning effect. However, when teachers use 3D software for model demonstration teaching in the process of teaching, the classroom of each semester is not fixed, the software should be installed repeatedly, the work should be repeated, and the students also have the requirements for 3D software learning. With the wide application of multimedia technology and mobile communication technology in educational technology, under the background of vigorously promoting educational informatization in the country, "micro-class", as a new form of educational information resources in the Internet era, is rapidly infiltrating into the teaching of university courses with its characteristics of "prominent theme, short and delicate, good interaction and wide application". At the same time, there are also a variety of mature methods and software to make microlessons. Therefore, the video technology of making difficult exercises in 3D software operation and drawing course is mature, and it can solve the above problems faced by the graphics course in our school, and at the same time, it can promote students autonomous learning and improve their learning effect. the advanced network conditions are fully utilized, and the website platform of school network classroom and excellent resource sharing course is utilized. Students can exchange learning situation with teachers through teaching website, download teaching materials, make microclass video for important and difficult contents, and promote students independent learning. It will play a good role in extracurricular teaching guidance through the teachers to answer all kinds of questions put forward by the students on the Internet and to discuss with the students. Through the extracurricular teachers take turns fixed-point regular tutoring to answer questions, to solve the remaining problems in learning.

IV. TEACHING EVALUATION METHOD OF THE ENGINEERING DRAWING COURSE

A. Evaluation mode of engineering course

The course assessment method is as follows: total evaluation score = 70% closed volume examination process examination score 30%, including closed volume examination 70%: according to the teaching goal of the course, focus on the students expression of mechanical drawings and the ability to read drawings, the mastery and application ability of important and difficult knowledge, the process assessment score 30%:

including exercise homework 20%, classroom test 10%, according to the teaching objectives of the course, the students ability to express mechanical drawings and read drawings, the mastery and application of important and difficult knowledge, and the process assessment scores are 30%. The specific items and assessment contents are shown in TABLE I.

TABLE I. CURRICULUM ASSESSMENT AND EVALUATION MODE

Examination items	Assessment requirements	Scale
Final	The basic knowledge and concept of mechanical drawings and drawings, the ability of reading and drawing drawings and the comprehensive application ability of theoretical knowledge are evaluated.	70%
Exercise assignment 1	The basic knowledge of drawing standard can be mastered by using geometry drawing, plane graphic size analysis and so on, and the basic engineering drawing can be drawn correctly.	5%
Exercise assignment 2	The three views of the combination can be read and drawn correctly.	5%
Exercise assignment 3	The common expression methods of machine parts can be used to draw mechanical drawings, and the expression methods of machine parts can be selected correctly, and the complete, correct and clear expression can be carried out at the same time.	5%
Exercise assignment 4	The mechanical pattern can be read by a skilled person.	5%
Pop-quiz	The basic theory of orthographic projection can be read to draw the orthographic projection of geometric elements and stereoscopes, and the ability of spatial thinking is good.	10%

From the table, we can see that exercise assignment 1 to exercise assignment 4, accounting for 20% of the total examination, is a necessary auxiliary means to mobilize students to actively participate in learning at ordinary times, classroom test is to draw a group of combined models, accounting for 10% of the total assessment results, the classroom test is the middle stage of the students to master the knowledge learned and comprehensive application ability assessment, in the middle of teaching, can further arouse students enthusiasm for learning; The final exam is the final examination, accounting for 70% of the total examination. The above assessment content to the two curriculum objectives assessment, there is a relatively balanced in class, after class assessment links. There are both extracurricular independent training link assessment but also class centralized training link assessment. It is also considered in promoting the communication between teachers and students, and the middle-term examination "classroom test" link is set up. According to the characteristics that the theory and practice of this course must be closely combined, the distribution of assessment score is more reasonable. In many aspects, many forms can effectively urge students to actively participate in teaching, with assessment content, form, score to support the rationality of curriculum objectives.

B. Analysis on quality Control of Engineering drawing Teaching

An effective teaching quality monitoring system has been established, including regular and independent student evaluation by the school educational administration department and immediate feedback from students. Improve the listening and evaluating system and put forward effective suggestions and opinions face to face. Make use of question-answering time to discuss with students to keep abreast of class teachers teaching and students learning. Teachers communicate with students in time, accumulate experience and solve difficult problems in teaching. It is necessary to manage and monitor the course practice teaching process effectively. In order to ensure the teaching quality, it is necessary to establish a teaching quality management and monitoring system composed of three systems: monitoring, evaluation and feedback. Establish a feedback system based on network platform and student feedback informers, supplemented by surveys, questionnaires and other feedback channels. Attach importance to students feedback on teaching, seek students opinions in time, and promote the continuous progress of teaching.^[6]

C. Continuous improvement analysis

According to the content and index point of curriculum assessment, the degree of achievement of each part is calculated, and the degree of achievement is analyzed, and the places where the degree of achievement is not good, and at the same time, an open channel is established to allow students to evaluate the curriculum and learning status. In the course of course teaching, the problems and opinions put forward by students are analyzed and improved, and the common problems are analyzed and improved. Through many ways, such as online and offline, as well as telephone, mail, WeChat, QQ group and so on, we collect and analyze the opinions on the teaching objectives and reach the target point, and establish a continuous improvement mechanism of curriculum teaching with the characteristics of "evaluation, feedback and improvement".

V. SUMMARY

The reform and practice of engineering drawing course based on OBE concept implement three basic concepts of

engineering education specialty certification: "Achievement orientation, student-centered, continuous improvement". The modular teaching idea is introduced into the engineering drawing course, and the idea of engineering practical design is permeated into the engineering drawing course teaching. The course teaching revolves around the engineering case, fully arouses the students autonomous learning ability, establishes the perfect teaching monitoring feedback system, forms the multi-form evaluation mode at the same time, stimulates the students study enthusiasm, improves the comprehensive ability to take the in-class teaching as the main line, the class and the extracurricular combination. The combination of teachers and students, from the knowledge classroom to the ability classroom, from the emphasis on learning and thinking to the combination of learning and thinking, from the emphasis on teaching and light learning to the teacher in learning, continuously improve and explore a new mode of training engineering talents.

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