

Exploration of Data Structure Teaching Mode Based on OBE Against the Background of New Engineering

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ABSTRACT

Output-oriented teaching is a new teaching concept advocated by colleges and universities today, which meets the requirements of new engineering teaching. The data structure course is a core computer professional course, which is very important for cultivating students' quality according to the new engineering teaching requirements. Therefore, the main content of this study is to construct a perfect data structure teaching model according to the OBE concept. This paper uses teaching output to guide the construction of teaching process and the cultivation of application-oriented talents, and analyzes and explores new teaching models from the construction of curriculum content, curriculum assessment, teaching methods and other aspects.

Keywords: OBE, Data structure, Teaching mode, New engineering.

1. INTRODUCTION

In recent years, OBE teaching concept has been widely recognized internationally. As a new teaching concept, it has been adopted by many developed countries. In OBE teaching, it is emphasized to build a teaching system with reverse thinking and cultivate students' various abilities as the goal, which has shown its effect in many practices. The China Engineering Education Professional Certification Association has certified the OBE teaching concept, and the "Opinions of the Ministry of Education on the Implementation of First-class Undergraduate Course Construction" also clearly puts forward the output-oriented course construction concept. Therefore, output-oriented curriculum construction, promoting in-depth reform of education and teaching, stimulating students' interest in learning and cultivating professional quality have become the new ideas of many teaching researchers[1-4]. This paper proposes an OBE-guided training mode for engineering talents, so as to meet the needs of professional certification and the guidelines of the Ministry of Education for

curriculum construction, and speed up the training process of applied talents.

OBE teaching is a goal-oriented teaching activity that focuses on what abilities can be developed, what students can achieve, and what goals can be achieved in teaching after the course is completed. When adopting this teaching concept, the teaching subject needs to formulate appropriate teaching plans to ensure that the corresponding teaching objectives are achieved after the teaching is completed. According to this concept, the corresponding teaching materials and contents need to be developed, and the corresponding teaching methods should be adopted to ensure the implementation of teaching activities. Different from traditional teaching, traditional teaching basically only takes into account the teaching process, designs the teaching content from the teaching conditions that the teaching subject can provide for students, promotes the teaching process in order, and finally completes the teaching task. The assessment of traditional teaching is carried out when the teaching process is completed. The assessment of whether the teaching objectives are

achieved or not is only carried out at the final assessment stage. This leads to a large discrepancy between the teaching process of the traditional teaching method and the teaching output, which is difficult to ensure the achievement of the teaching objectives. When implementing OBE teaching, the first and always adhere to is to achieve students' ability goals. According to this goal from beginning to end, calibrate the teaching content and process to ensure the cultivation of students' theoretical and practical abilities. This goal-oriented teaching can correct errors in the teaching process in time and ensure the achievement of teaching output.

In recent years, with the development of education, many achievements have been made in the teaching and research of computer data structure course. Chen et al.[5] discusses the construction content and reform method of data structure course in undergraduate education, and puts forward the teaching method and new mode discussion of data structure based on actual teaching experience. But et al.[6] explored several problems of CDIO in data structure teaching, proposed the application of PBL teaching mode in data structure bilingual teaching environment, and found that this teaching mode is helpful to improve teaching quality and improve students' ability in practice. Zang et al.[7] studies the problems in the teaching of data structure, proposes to improve the teaching process with the help of demonstration software and Flash tools, reasonably design teaching practice activities to carry out teaching reform, and improve the overall effect of course teaching. Xiang et al.[8] studies the impact of teaching content innovation, tool means improvement, and practice plan strengthening on the reform of data structure curriculum, analyzes the practical problems faced, and designs the training methods of data structure algorithm application related skills, with a view to improving students' algorithm thinking and practical ability. Yu et al.[9] discusses the content construction and teaching reform methods of data structure course in undergraduate education, studies the benign growth in the course reform and the construction of experimental platform, and discusses the practical problems faced according to the experience and lessons learned in the data structure teaching practice. Yang et al.[10] has studied the application of SPOC mixed teaching mode in data structure courses, combined online teaching with offline teaching, studied student differences and learning motivations, proposed layered teaching methods, and gave full play to the auxiliary role of online

platform to improve the final effect. According to the objective of cultivating innovative talents, Che et al.[11] introduces the online learning platform to carry out flipped teaching attempts, promote professional ability training, propose a teaching mode of driving flipped classes with tasks and cases, and hold competitions to promote students' participation, so as to improve students' ability to deal with practical problems. Zou et al.[12] proposes to use CDIO teaching mode to carry out data structure teaching, focusing on students, combining with project-based teaching process, and try to solve problems in traditional teaching process, so that students can learn project understanding and project application ability. Zhang et al.[13] has studied the engineering certification in the practical teaching of data structure, taking the practical teaching as the core of the teaching content, taking the transportation industry service as the entry point and feature, and constructing the practical case with the algorithm knowledge points to realize the standard, systematic and scientific teaching case. The course of data structure includes theory and computer practice. Through programming technology, the algorithm thinking is taught to students, and students' programming skills, algorithm thinking and engineering ability are cultivated, laying a foundation for the course system of computer science. There are also some new literatures that study the mixed mode teaching of data structure, and have achieved good teaching results [14-19]. In short, the existing research results have high value and have a positive impact on promoting the teaching reform of the data structure course. With the development of educational modernization, how to make the teaching of data structure course meet the needs of new engineering courses has become an important topic to be studied at this stage, and the OBE teaching concept can better meet this practical needs.

2. CURRICULUM REFORM CONTENT

In order to meet the practical needs of the new engineering education, this paper studies the teaching method of data structure course based on OBE, from the aspects of outline formulation, content design, theoretical interpretation, computer practice and course assessment, with a view to improving students' thinking ability, hands-on ability and innovation ability when facing practical problems, so as to comprehensively train their engineering training level ("Figure 1").

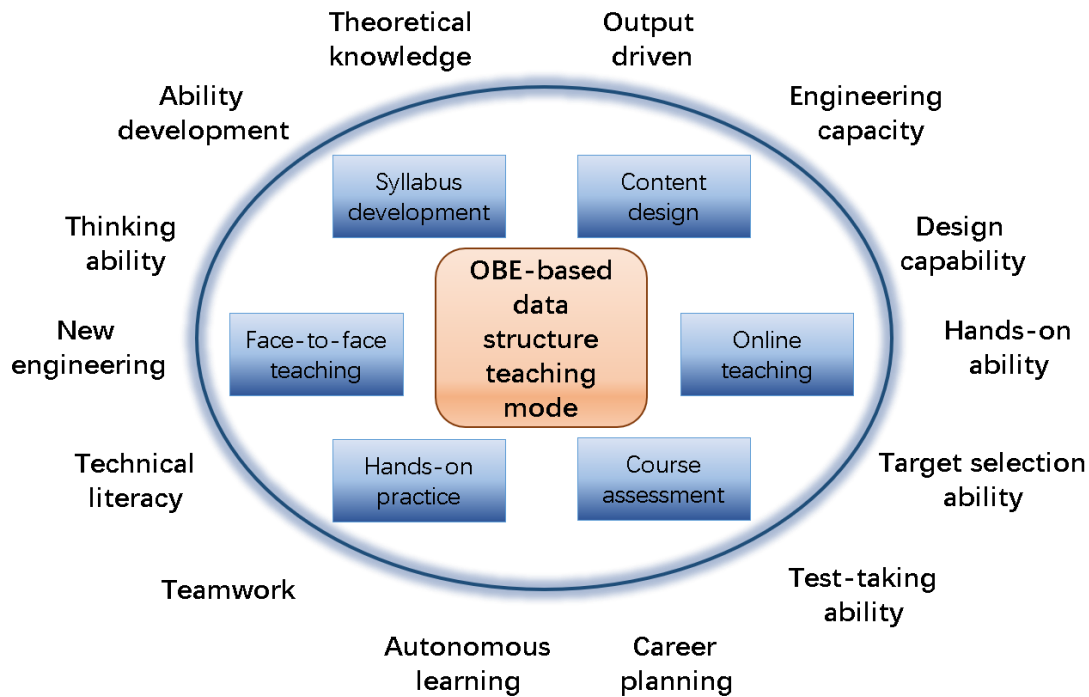


Figure 1 Exploration of data structure teaching mode based on OBE.

2.1 Syllabus development

Based on the OBE method, the outline is formulated. First, the preliminary design is carried out according to the teaching output, and then the professional training objectives are considered, so as to develop the indicator system of students' learning requirements. Integrate the OBE concept into the data structure teaching reform process, and comprehensively cultivate students' thinking ability, theoretical knowledge and skill accomplishment.

2.1.1 Thinking Ability

After the course is completed, students should develop independent, multi-dimensional and dialectical thinking ability, be able to face problems, analyze and solve problems by their own strength, view problems from multiple perspectives, analyze problems from multiple dimensions, and solve problems with dialectical views, so as to have the habit and ability of objective and pragmatic thinking and solving problems. According to the OBE learning concept, the teaching output will be throughout the course of learning, requiring students to develop the habit of thinking from beginning to end, and the thinking of analyzing and solving problems will be throughout the course of learning, forming the habit of thinking, analyzing and analyzing, so that beneficial thinking activities

will always guide the practice process, ensuring that learning and practice do not deviate from the final goal, and successfully complete the course. This good thinking habit focuses on cultivating lifelong thinking habits for students and learning to carry out engineering practice activities intelligently.

2.1.2 Theoretical Knowledge

At the end of the course, students should not only master the concepts of the course, but also understand the important types, structures and applications of data structures. Students should be able to master the basic terms of algorithms and master several important data structures, such as linear table, queue, stack, binary tree, forest, graph, sorting, etc. After understanding and mastering these data structures, students will implement specific algorithms based on programming technology, and then use these data structures for program design to efficiently solve problems.

2.1.3 Skills and Accomplishments

At the end of the course, students should have all kinds of basic professional skills required by computer majors, have the ability to recognize and analyze computer algorithms, can reasonably design algorithms, program and implement, and can

apply knowledge to practical problems. Students should also have the ability to explore, construct and innovate knowledge. In addition, students should also have good scientific, technical, professional and mental health, and optimistic outlook on life, morality and socialist values. Students should also have the correct political quality and patriotism, and set up the lofty ambition of studying for the country and establishing a career for the people. Through the study of this course, we finally cultivate the comprehensive quality of having the motherland in our heart and the fine work in our hands.

2.2 Teaching content design

In the previous data structure course teaching, the theoretical class hours accounted for more than 70%, which is not conducive to the improvement of students' autonomous learning and practical training ability. In view of this, increase the proportion of experimental and practical training hours and independent learning time to 50%, appropriately reduce theoretical class hours, reduce students' fatigue of theoretical listening, and increase students' learning enthusiasm and application ability training opportunities. Considering that students often have a weak foundation of C language at the beginning of this course, we will add C language grammar class hours commonly used in data structure at the beginning of the course, including theory and computer practice. The data structure has a wide range of contents. According to the application and the requirements of the postgraduate examination, the content and class hours of each chapter are adjusted appropriately, the content with strong applicability and the key points of the postgraduate examination are explained as the key content of the theoretical course, and the content commonly used in the practical application project is appropriately added with practical exercises and independent learning. In terms of the selection of learning content, it is ensured that students' autonomous learning ability, application ability and innovation ability can be developed at the end of the course.

In the explanation of theoretical content, the mixed teaching mode of Interactive autonomous learning is adopted ("Figure 2"). First of all, the content of autonomous learning before class should be arranged in a targeted way so that students can preview and start the learning of this theory class after learning. At the same time, the content should

be arranged from easy to difficult, so that students can enter the class with questions. The teacher should concentrate on explaining the key theoretical content that students have questions. The explanation process of each theoretical content gradually transits from pure theory to practice preparation stage to prepare for the practical programming of the algorithm. In the way of explanation, we should strive to be practical and applicable, break through the single PPT explanation, and promote the content explanation by means of student interaction, blackboard decomposition, animation demonstration and other means. At the same time, the online course was recorded, and the key content and detailed explanation were put on the online learning platform for students to check and fill in the gaps and learn the new.

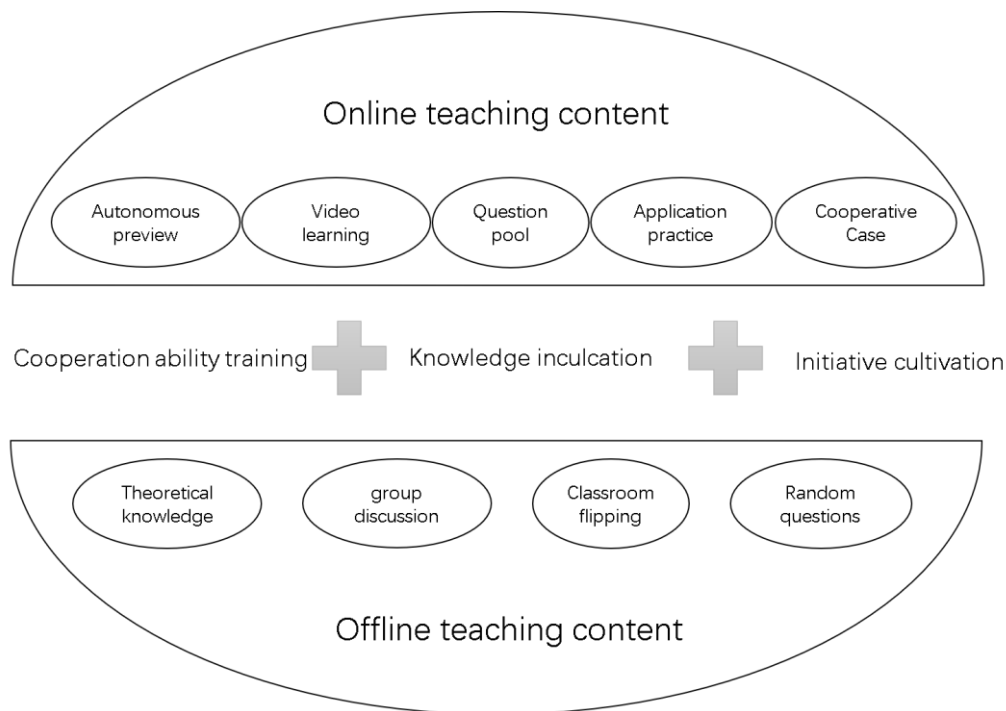


Figure 2 Teaching content design.

2.3 Hands-on practice

When practicing on the computer, we should pay attention to the cultivation of students' autonomous learning ability and hands-on ability. The teacher's responsibilities are mainly task setting, guidance tips and key content demonstration. By setting and arranging appropriate autonomous design and programming tasks at the beginning of the computer, inserting appropriate guidance tips in the class, constantly inspecting, guiding and adjusting the details of the task, and analyzing the key and difficult points and demonstrating the operation at the key points. Take students as the main body to complete the experiment process, and change roles through excellent works display and students on the stage to realize interactive communication. In the later part of each theoretical course, theoretical preparation is made for the practice on the computer, so that the practice on the computer can be smoothly transited and implemented. In the practice of computer operation, we will add the foreshadowing for the next theoretical content, let students query and realize independently, guide the upcoming theoretical content, and stimulate students' interest in coherent learning.

2.4 Course Assessment

The proportion of the final examination in the traditional course assessment is about 70%. After the OBE-based teaching concept is adopted, the course assessment method will also change. Due to the emphasis on autonomous learning and interaction in the course content setting, theoretical explanation and computer practice, the assessment of autonomous learning is arranged on the learning platform and scored through online assessment. In the explanation of theory class, students climb the blackboard, students go on the stage to explain knowledge points and interactive questions and answers are scored and included in the assessment. Set part of the online content as the form of team cooperation, and achieve the assessment of the cooperation content by reasonably allocating the division of labor among team members. Add midterm tests to evaluate the phased learning effect of students, so that they can know well and adjust their learning status in time. Through the refinement of the above assessment methods, the proportion of the final examination is reduced to 50% ("Figure 3"), so that students can feel the gradual achievement of the final learning effect in the learning process.

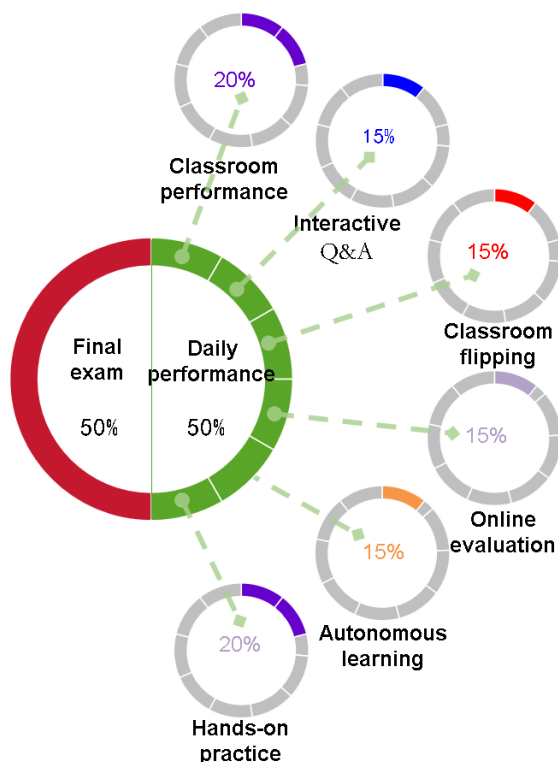


Figure 3 Course assessment method.

3. CONCLUSION

Adopting OBE teaching method to carry out data structure curriculum reform will help to achieve the final teaching goal, more fit the student-oriented education concept, and greatly help to mobilize the enthusiasm and initiative of students. Based on the OBE concept, the teaching content is adjusted to highlight the role of autonomous learning and interactive communication in theoretical courses, and to give full play to students' initiative in computer practice. In the course assessment, we should be goal-oriented, throughout the course, set the assessment objectives before, during and after the course, incorporate independent learning and interactive communication into the assessment system, increase the assessment of team cooperation content, and achieve consistent and consistent goal assessment throughout the course. Through the implementation of the OBE concept, the data structure course can better achieve teaching output, lay a solid foundation for subsequent courses, and enable students to acquire excellent algorithm thinking and professional literacy.

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