

Research and Reform of “Fluid Pipeline Network” Adopting Mixed Teaching

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Abstract : In order to improve the teaching quality of the “fluid transmission and distribution network” course, deepen the understanding and cognition of “fluid transmission and distribution network”, and improve the cultivation of students’ core competence, this paper proposes the use of “fluid transmission and distribution network” the reform plan of blended teaching.

Keywords : Fluid Transmission and Distribution Network; Core Competence; Teaching Reform; Blended Teaching

Engineering certification is an inevitable trend in the reform and development of engineering education. The goal of engineering education certification is to confirm the quality of professional education, that is, to train students’ achievements, to confirm that the professional can continue to achieve the customized education goals and that the graduates have the required professional skills. Encourage the maintenance of education quality and continuous improvement through the certification mechanism.

Guangdong Ocean University’s building environment and energy application engineering (referred to as the construction environment major), based on the revision of the engineering certification, is to cultivate and master the basic theories and professional knowledge of the construction environment major, obtain basic training of engineers and have a certain degree of innovation in composite engineering technology talent. In the process of design, construction or technical management related to construction and environmental protection, it is very important for engineering and technical personnel to study and solve problems in engineering from an engineering perspective in a comprehensive and strict manner. Therefore, it is very important for the engineering awareness and the cultivation of practical ability is the top priority of teaching reform.

1. The necessity of teaching reform based on the course of engineering certification “fluid transmission and distribution network”

As one of the important and compulsory theoretical basic courses for the construction environment major, “fluid transmission and distribution network” is a bridge between the professional basic courses and professional courses. This course mainly teaches various pipe network types and devices, hydraulic characteristics, hydraulic calculation methods, matching of pumps, fans and pipe network systems, and working condition adjustment.

2. The goal and specific content of the mixed teaching reform of “fluid transmission and distribution network”

2.1 Through mixed teaching, the diversity of classroom teaching is realized and the core ability of students to use basic knowledge is strengthened

In teaching, it is necessary to be student-oriented. Teachers cannot instill theoretical knowledge in one direction. They need to use various resources and methods to fully mobilize students’ enthusiasm and inspire students to think. Carry out the design of the

flipped classroom, use a variety of methods to achieve mixed teaching, the process of explanation uses multimedia such as micro-classes, engineering pictures, animations, etc., effectively mobilize students' emotions and increase perceptual understanding. Students in class ask questions and discuss with each other to solve problems. Both students and teachers participate in the teaching and realize teacher-student interaction. Students gradually sort out, understand and master knowledge in their thinking and problem solving.

2.2 Theoretical teaching should be closely integrated with engineering cases to cultivate students' engineering thinking

The basic theories and methods of the course are derived from engineering practice, and the purpose of learning is also to apply these theories and methods to solve practical problems. In classroom teaching, select appropriate engineering cases for important knowledge points. Teachers should use typical and representative cases to explain thoroughly and appropriately extend, such as guiding students to analyze the differences and connections of different types of pipe networks, so that students can gradually form analogy analytical capabilities. It is necessary to be able to inspire students with engineering examples, stimulate their motivation to learn, and make boring theories more vivid and intuitive.

2.3 Strengthen the teaching of experimental links

Strengthen the teaching of experimental links, especially the comprehensive experimental links, conduct comprehensive experiments through groups of students, design experimental procedures by themselves, and require students to compare theoretical knowledge and experimental results obtained by themselves to deepen their understanding, thereby enhancing students' hands-on practical ability and perceptual cognition level, in order to cultivate students' ability to design and execute experiments, as well as analyze and interpret data, and cultivate students' independent learning and innovative thinking.

2.4 Reform the assessment method

Perform comprehensive reform of course assessment and evaluation, teaching methods and homework methods. Appropriately increase the proportion of daily assessments, arrange appropriate classroom questions and homework combined with actual engineering cases, so that students can combine case thinking, analysis and discussion in class, and "experience" the application of theoretical methods while completing homework after class. It enables students to deepen their understanding and gradually master its application methods, and deepen their understanding of the content of "fluid transmission and distribution pipeline network" and the professional connotation of building environment and equipment engineering.

3. The implementation method of "fluid transmission and distribution network" adopts mixed teaching

(1) Understand the latest teaching methods and make micro-classes of the "fluid transmission and distribution network" course, including PPT, videos, etc., to facilitate students' pre-class preparation, inter-class learning and after-class review.

(2) Learning application mobile teaching software. Through the investigation, students have a high evaluation of the use effect of the Rain Classroom. In the "fluid transmission and distribution Network" class, let students use the scan code check-in function and test paper library test, and use the Rain Classroom for class interaction to attract students' attention.

(3) Carry out the design of the flipped classroom and use a variety of methods to achieve mixed teaching. Before class, students are allowed to understand the basic concepts through micro-classes, and students are encouraged to read relevant domestic and foreign literature. Use the mobile teaching platform to test the knowledge points in class to keep abreast of students' knowledge mastery. Students discuss and analyze the knowledge points of the course and explore cutting-edge research results in groups, and ask questions in the class about fluid transmission and distribution network problems encountered in life. Finally, the teacher will teach relevant teaching content and answers to the questions based on the results of the students' discussions.

(4) Strengthen the refinement of the commonality of the fluid distribution pipeline network. Summarize and summarize the functions and composition, classification, connection between pipe networks, pipe network hydraulic characteristics and hydraulic calculations, pump (fan) and pipe network matching, pipe network hydraulic conditions analysis and adjustment, etc., refining commonality. The various pipe networks involved in the profession can be summarized into two categories: open and closed, branched and ring. By introducing the concept of virtual pipes and virtual closures, energy conservation is used to establish closed loop energy equations for various branched pipe networks, thereby constructing general pipe network hydraulic calculations, hydraulic conditions analysis and pipe network adjustment theories.

(5) Reasonable construction of engineering cases. There are two types of engineering problems in the major of architectural

environment and equipment engineering: fluid transmission and distribution and heat and mass exchange. The fluid transmission and distribution pipeline network course is based on the professional basic course fluid mechanics. Students can understand fluid transportation through this course. The importance of piping network in the profession, understand the role of fluid transmission and distribution piping network in various projects and its relationship with other components of the project, and master the pipe network through the cooperation of practical teaching links such as production practice and graduation design. Grasp the basic theories and methods of network system design and calculation, working condition analysis and adjustment, form preliminary engineering practice capabilities.

(6) Experimental settings set up special experimental teaching for key teaching content to strengthen students' perceptual understanding of teaching content and improve students' interest in learning. At present, a comprehensive experimental platform for the series and parallel pipe network of centrifugal pumps and a performance test platform for fluid flow pipe networks have been added. The centrifugal pump comprehensive test bench can determine the characteristic curve of the centrifugal pump, and carry out the series and parallel experiments of water pump cavitation and water pump; the fluid flow pipe network performance test bench can simulate and test the primary and secondary pumps of the air-conditioning water system with a constant flow rate. The water running characteristics of variable flow pipe network can realize the design and measurement of a variety of experimental tasks.

(7) Analyze the test papers, and review and explain the results of students' learning and core competence, find the core competences that are not enough to be cultivated, and carry out continuous improvement, revise plans and methods, and form stepped continuous progress. Arrange appropriate classroom questions and homework combined with engineering cases, and use the above performance as the usual grades. The pros and cons are included in the course assessment results to increase the proportion of usual grades. Promote students to consciously carry out extracurricular preparation and review, actively participate in related research activities, and learn from extracurricular materials.

4. Conclusion

The use of hybrid teaching in “fluid transmission and distribution network” can not only increase classroom interaction and communication, and allow teachers to grasp the learning situation of students in real time, but also facilitate the exchange of online resources; reasonable introduction of engineering cases, self-designed experimental procedures and other reform methods contribute to the cultivation of students' engineering thinking and cultivate environment-building talents with new requirements in the new era. At the same time, the mixed teaching reform requires teachers to rationally organize online and offline courses, strengthen engineering practice experience, understand the demand for talents in engineering practice, understand the frontiers of the subject and development trends, and have the ability to research new engineering technologies, so as to better cultivate students' core abilities.

References

1. Gu Z, Liu J, et al. Exploration of the teaching reform of the “fluid transmission and distribution network” course based on “engineering awareness” training. *China Electric Power Education* 2013; 23: 85-86.
2. Zhou Y, Sun X. Construction of the quality evaluation system for talent cultivation in higher engineering education——Thinking under the background of international professional certification. *University Education* 2019; 5:144-147.
3. Ren Z, Zhou M, Deng Q, et al. Research and practice of mixed teaching mode for building energy efficiency courses. *Higher Architectural Education* 2019; 28(2): 93-100.
4. Fu X, Deng X, Sun C, et al. Investigation and analysis of the practical teaching effect of the architectural environment and equipment engineering specialty. *Higher Architectural Education* 2009; 18(1): 16-21.