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Research Article

Preliminary Study on the Teaching Reform of Hydraulic Structure Curriculum Based on the Excellent Engineers Training Program in Water Resources and Hydropower Engineering

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Abstract

Drawing on the advanced engineering education concept, according to the requirements of the excellent engineer training program of water conservancy and hydropower project, combined with the characteristics of this major and the orientation of talent training, aiming at the current situation of the teaching of hydraulic structures, from the curriculum teaching objectives, curriculum teaching content and plan, the teaching methods and the assessment system, curriculum teaching reform research are carried out, and the engineering and technical talents can learn to use and be seamlessly connected with the employer.

Keywords

Water Conservancy and Hydropower Project Specialty • Excellent Engineer Training Program • Hydraulic Structure Curriculum • Teaching Reform

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Guided by the "National Medium- and Long-Term Education Reform and Development Plan (2010-2020)" and "National Medium- and Long-Term Talent Development Plan (2010-2020)", Implementing the spirit of the Ministry of Education on Several Opinions on the Implementation of the Education Program for Excellence in Engineers (Teaching [2011] No. 1), the Water Conservancy College of North China University of Water Resources and Electric Power began to implement the excellent engineer training program for water conservancy and hydropower engineering in 2012, drawing on the successful experience of advanced engineering education in the world's advanced countries, relying on national characteristic specialty and provincial major curriculum, with the goal of cultivating "excellent water conservancy engineers with strong practice, management, and innovation", the school-enterprise unity is the platform, and the work-study is the method, reform of the curriculum system is the core, with the construction of policies and institutional systems as the guarantee, actively explored and practiced the new model of "3+1" professional talent training ; at the same time followed the social demand-oriented and practical engineering as the background, The principle of engineering technology as the main line, through adjusting training programs, improving of the quality assurance system, strengthening the management of each link, and making efforts to promoting high engineering students' engineering awareness, engineering quality and engineering practice ability (Liu & Bai, 2014; Liu, 2011; Liu & Ma, 2014).

In this context, the reform of the hydraulic structure curriculum is particularly important as a core curriculum in the excellent engineer training program for water conservancy and hydropower project. In view of the existing problems in the current teaching of hydraulic structures, this paper will carry out reform research from four aspects: curriculum teaching objectives, curriculum teaching content and planning, teaching methods and assessment system.

The current situation of the teaching of a hydraulic structure curriculum

As a core curriculum in water conservancy and hydropower project, hydraulic structures have accumulated rich experience in many years of teaching, but there are also many problems.

The professional curriculum is not closely connected with the previous basic curriculums.

The curriculum system lacks overall optimization. The study of hydraulic structures requires the application of pre-stage theoretical mechanics, structural mechanics, material mechanics, soil mechanics, hydraulics, reinforced concrete structures, etc. However, the study of the various curriculums in the previous period was not combined with the actual water conservancy project, which made it difficult for students to apply these pre-curriculum knowledges in the process of learning the hydraulic structure curriculums. However, studying the various curriculums was not combined with the actual water conservancy project, which made it difficult for students to apply these pre-curriculum knowledges in the process of learning the hydraulic structure curriculums (Liu, 2018; Huang & Peng, 2013; Zheng, 2002).

Theoretical teaching and engineering practice are out of step

There are rich content, theoretic knowledge, and universal, but engineering practice teaching is too little, many students to understand the basic engineering concepts enough in the learning process and lack of knowledge of the actual project. They cannot build a combination of theoretical knowledge and engineering practice well.

Single assessment mechanism

At present, the curriculum assessment usually adopts usual attendance + classroom question and answer + experimental score+final close exam, and exam scores account for a large proportion, This leads to a unsatisfactory phenomenon that students usually do not actively study, do not take the initiative, and review before final exam. In addition, the test are biased towards the theory and not closely integrated with practice. Students often memorize and not think, analyze and innovate, forming a common problem that is usually loose, pre-tested, and forgotten after the exam, seriously affecting the cultivation and improvement of talents.

Teaching Reform Measures of Hydraulic Structure Curriculum

Curriculum teaching objectives

Different from the training objectives of ordinary undergraduate students, the excellent engineer training program for water conservancy and hydropower project aims to cultivate the future excellent water conservancy engineers with strong practice, management and innovation (Tang & Tan, 2016; Zou, 2018; Han, 2013). It has a solid foundation in natural sciences and humanities and has foreign languages. And computer application ability, get the basic training of engineers, master the basic knowledge and professional skills of water conservancy and hydropower engineering survey, planning, design, construction and engineering management, international knowledge with broad knowledge, strong ability, high quality and innovative spirit. Technical talent. Based on this, the teaching of hydraulic structure curriculums strives to enable students to have the following abilities: (1) master the working principle and working conditions of hydraulic structures; (2) master the requirements for the arrangement of various hydraulic structures in water conservancy projects, It can design and safety review hydraulic structures according to local topography, geology, hydrology, etc.; (3) Master the relevant content, methods and procedures for construction preparation, construction process and management and completion acceptance of hydraulic structures; (4) Master the content and requirements of operational management and safety observation of hydraulic structures.

Curriculum content and plan

The existing hydraulic structure curriculum content includes the following chapters: introduction, hydraulic structure design review, gravity dam on rock foundation, arch dam, earth-rock dam, sluice, shore spillway,

hydraulic tunnel, gate, dam The 12 chapters of buildings, canals and canal buildings and river remediation buildings, water conservancy engineering design and hydraulic structure management, the daily teaching content is also taught in accordance with the chapter from front to back. Although the forms and structures of various buildings are diverse, after analysis and summarization, it is not difficult to find that the curriculum can be roughly divided into six aspects, including: basic concepts and principles, overall layout And design, safety and structural calculations, ground handling, construction organization and operational management. In actual teaching, the common content of different types of hydraulic structures is repeated in different chapters. If the textbook is published, it will waste more teaching time.

On this basis, the teaching contents and plans can be rearranged, specifically including:① In accordance with the layout of the chapters, the concept, principle and applicable conditions of each hydraulic structure are explained first, and the general layout content and design requirements are explained;② For the common safety and structure calculation and foundation treatment, the unified explanation of its load and load combination, the basis and judgment method of safety and mechanism calculation, and the unified explanation of different foundation treatment methods and requirements;③ Strengthen the practical teaching content, through the actual different topographic geology and hydrological conditions, explain to students how to choose hydraulic structures and overall layout and design, how to carry out relevant calculations, how to carry out foundation treatment and construction organization, etc., so that students can deeply understand the similarities and differences of various hydraulic structures and applicable conditions.

Reform of teaching methods

In the teaching process of "Hydraulic structures" of the training plan for outstanding engineers of water resources and Hydropower Engineering specialty, the old cramming teaching method should not be adopted any more. The teaching method should be closely linked to the goal of improving students' practical ability. According to different teaching contents, modern teaching methods should be adopted to improve the teaching effect (Cao, 2013).

In any case, the reform of teaching methods is to solve the two core problems of "how teachers teach" and "how students learn". At present, OBE (Outcome-based education) is one of the most popular educational concepts in the world (Dong & Su, 2017). One is the transformation from inculcation classroom to dialogue classroom, that is, the classroom teaching is changed into a question mark class. The second is the change from closed classroom to open classroom, which originally surrounded the three centers of teachers, classrooms and textbooks, to the expansion of time, space, classroom, library and laboratory, and content from textbooks to reference materials. Thirdly, from knowledge classroom to ability classroom, teachers change textbooks into teaching plans and then into PPT, so that students not only attach importance to memory, understanding and application, but also to analysis, evaluation and creation, so as to realize high-level cognition. Fourthly, it is a shift from attaching importance to teaching and neglecting learning to focusing on what teachers teach and what students learn. It is a shift from teaching to "learning by pleasure", "learning by learning", "learning by learning", "teaching by not teaching" and "learning by learning".

Based on the OBE educational concept and the characteristics of the curriculum of hydraulic structures, the following teaching methods can be reformed:

(1) We should make rational use of modern teaching methods to promote the improvement of teaching quality. By means of pictures, animation, audio-visual and other means, the design principles, structural forms, stress process and destruction mechanism of various buildings are visually displayed, so as to give students a perceptual understanding, turn abstraction into concrete, and improve their learning enthusiasm. At the same time, the network teaching platform of curriculums is established. Curriculum ware, syllabus, teaching pictures, animation, video, exercises and thinking questions are listed in the network teaching platform. Students can read and watch at any time, which greatly improves the teaching quality.

(2) Learning to apply, students participate in teaching mode. For a certain hydraulic structure, teachers provide basic information such as topography, geology and hydrology, so that students can arrange, design and calculate safely in groups after class, explain the design ideas in class, and teachers can comment on them. To achieve the goal of combining students' theory with practice, learning to apply, improving initiative and enthusiasm.

(3) Teaching with advanced commercial software. With the development of computer technology, more and more requirements of finite element analysis have been added to the design specifications of hydraulic structures. The structure of hydraulic structures is complex and the amount of calculation is large. Many problems can not be solved by manual calculation. In the process of teaching, simulation models can be established through the teaching of advanced commercial software to visually display the construction. The structural deformation and destruction process under the action of loads enable students to intuitively understand hydraulic structures, learn to use advanced software for analysis, and improve their enthusiasm for learning.

(4) Field oriented engineering practical problem-solving oriented Teaching. Because the construction is a complex space structure, taking students to the site to witness the building for on-site teaching can enable students to have a clear understanding of the composition and structure of the hydraulic structure, and can be combined with on-site engineers to understand the specific problems and solutions in the construction and management of on-site projects, and guide them. Students think about it and establish a learning concept that aims at solving practical problems.

Reform and construction of curriculum assessment system

Curriculum assessment should focus on the mastery and practical application of knowledge (Yang & Chai, 2017; Zheng, 2006; Cai *et al*., 1999). It is not advisable to over-examine the content of definitions, concept, etc.. Curriculum assessment should highlight the comprehensive ability assessment, and establish an assessment method that reflects the comprehensive quality of students in various forms. Based on this, reforms should be made from the following aspects:

(1) Focus on process assessment and diversified assessment methods. The assessment of students will

be injected into the whole learning process, including attendance, class discussion, debate, homework assignments, experiments, study summary reports, etc., mainly to examine students' mastery of classroom content, and urge students to learn after class, improve self-study ability.

(2) The content of the test questions is practical and integrated. In addition to the basic theory, basic knowledge and basic skills of the curriculum, the examination content should also focus on assessing students' comprehensive application of basic theoretical knowledge and engineering practice, as well as deep understanding, analysis, comparison and integration of knowledge to facilitate analysis and resolution the comprehensive ability of the problem, etc. Reduce the proportion of objective test questions, increase subjective and comprehensive test questions, give students greater freedom to play their space, and guide students to develop in an all-round way.

(3) Assessment results focus on practice and innovation. Revising the evaluation criteria of curriculum performance, focusing on the cultivation of students' ability to apply and the ability to innovate, only when students have good grasps of basic theories, basic knowledge and basic skills, have certain analytical and problem-solving abilities, and have initial ability to innovate, can give them excellent grade. With reformed the assessment scoring method, strengthened the practical application skills and innovated skills, diluted the test scores, and gradually implemented substantive evaluations to reverse the student's attitude toward late-stage surprise learning and stimulate students' interest in the whole process.

Conclusion

As a professional core curriculum in the excellent engineer training program in water conservancy and hydropower project, hydraulic structures are a very practical curriculum. The reform should be combined with the objectives of the excellent engineer training program, focusing on the actual ability of the project. This paper carries out reform research from the four aspects of curriculum teaching objectives, curriculum teaching content and planning, teaching methods and assessment system, and strives to achieve a close integration of theoretical teaching and practice, so that students will be exposed to the actual project in advance in the school on the basis of mastering the basic theoretical knowledge, so as to improve the professional cognition level and achieve the application of what they have learned. In order to adapt to the actual needs as soon as possible, they will become professional and innovative international engineering and technical personnel have laid a solid foundation.

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