

Teaching Reform Practice of Hydraulic Engineering Specialty

Shoukai Chen^{1,*}

¹College of Water Conservancy, North China University of Water Resources and Electric Power, Zhengzhou, 450045, China

*Corresponding author

Abstract: Hydraulic engineering in flood control, drainage, disaster prevention, mitigation and other aspects of the development of the national economy has made a significant contribution, while in industrial production, agricultural irrigation, residential life, ecological environment and other production and management play a huge role. At present, the teaching of water conservancy is difficult to meet the needs of Hydraulic engineering-related units for related professionals, and the professional knowledge of students in water engineering does not meet the current requirements of society. In this paper, for the original teaching of Hydraulic engineering, it is suggested that the teaching system of colleges and universities should be comprehensively reformed in terms of professional quality, teaching staff, practice platform and teaching assessment.

Keywords: Hydraulic engineering; teaching reform; ability cultivation; practice

1. Introduction

The training of Hydraulic professionals in colleges and universities is mainly aimed at planning, design, construction and scientific research in the field of Hydraulic applications. With the development of society and the continuous adjustment of economic and industrial structure, the development of Hydraulic industry has also changed. On the one hand, due to environmental constraints, large enterprises in the Hydraulic industry are optimizing the industrial structure, changing from monotonous Hydraulic enterprises to multi-faceted enterprises, and the scale of activities is constantly expanding. On the other hand, within the framework of the "Belt and Road Initiative" initiative, China's Hydraulic enterprises are full of vitality. Chinese Hydraulic enterprises promote international development and have certain advantages in the field of international hydropower construction. Many large reservoirs and hydropower enterprises account for more than 1/3 of their global business. The development and transformation of hydropower industry has put forward new requirements and objectives for the training of hydropower talents in colleges and universities, so a new training system is needed.^[1] This paper introduces the new teaching system from the aspects of professional quality, teaching staff, practice platform, teaching examination and so on.

2. Cultivate professional quality and skills and build a systematic curriculum system

2.1. The Reform of the training Mode of Professional quality and ability

Colleges and universities should strive to train professionals who can meet the needs of society, so that every graduate can complete his mission. Hydraulic projects are no exception. Therefore, the college needs to rebuild its own curriculum system according to the professional engineering characteristics. The specific practice of the college can be as follows: by actively changing the traditional teaching method of "emphasizing theory over practice", so that the students majoring in Hydraulic engineering can have a better understanding of the basic professional knowledge. There are clearer theoretical understanding and preliminary practical skills in the construction design, management and use of Hydraulic projects and small hydraulic structures, so as to meet the actual needs of the grass-roots level. The talent training plan should pay attention to the organic combination of basic knowledge and engineering ability, and focus on training senior applied talents in the front-line construction of Hydraulic facilities.^[2] Therefore, it is necessary to build a reasonable and practical talent training plan, focusing on the professional training of on-site construction technology and management of talents in the field of Hydraulic engineering.

Optimize and adjust the existing vocational training system, reform the traditional curriculum, integrate the relevant curriculum content, highlight the core professional knowledge as the central line, build a rational curriculum focusing on ability training and employability, and build a curriculum system that combines theory with practice.

Teachers can carry out basic vocational quality education in professional courses, or they can make use of the opportunity of enterprise training to influence students with corporate culture, so as to improve students' basic professional quality. At the same time, targeted to improve students' moral awareness, integrity awareness, teamwork and other professional qualities.^[3]

From this, it can be known that the Hydraulic industry has an urgent demand for talents with relevant professional abilities. The professional ability can be expanded from the aspects of water saving and water ecological protection. Through internship, students can get in touch with the real working environment and exercise all kinds of abilities needed for the post, so that they can better improve their professional ability and deal with follow-up study more pertinently. Through practical training, students' social experience and professional accomplishment have been improved, laying a solid foundation for their future work.

2.2. Reform of professional curriculum system

In view of the current situation of the development and reform of the Hydraulic industry, in order to train professionals to meet the needs of modern water conservancy enterprises, we must start with cultivating students' knowledge, ability and quality, and fully combine the requirements of the professional ability of Hydraulic engineers to innovate and reform the professional curriculum system. By learning the skills and related knowledge required by this major, we can reconstruct the whole curriculum system of the Hydraulic engineer profession. After analyzing various work tasks, core competencies, competence elements and requirements for professional abilities, we can purposefully develop professional courses and supplement them with real professional knowledge.^[4]

3. Construction measures of Teaching Reform of hydraulic Engineering Specialty in Colleges and Universities

In order to implement the reform practice of Hydraulic engineering teaching in colleges and universities more efficiently, in view of the current development situation and current situation of the industry, the college should improve and improve the relevant construction measures.

3.1. Improve the overall quality of teachers

In order to train high-quality talents with practical skills more effectively, colleges should reform the existing teaching mode, establish all-round cooperation between colleges and enterprises, build a team of "dual-qualified" teachers, and make teachers' professional ability reach the level of the production line. The college regularly sends a certain number of teachers to relevant enterprises for internship every year, so that Hydraulic engineering teachers can reach the professional level of "double qualification". In addition, colleges can guide teachers to teach vocational training theories and educational concepts, so as to keep up with modern teaching ideas and keep pace with the times.^[5]

3.2. Strengthen the integration between colleges and enterprises

Colleges and enterprises in related industries should set up professional construction committees to achieve win-win results through in-depth cooperation between colleges and enterprises and fully combining their respective advantages, resources and expertise. According to the platform advantages of water conservancy companies, market research should be carried out, and with the help of the research of the Construction Commission, the technical requirements should be combined with the employment needs of Hydraulic engineers to formulate talent training goals.^[6] colleges and enterprises should formulate feasible implementation plans in the aspects of cooperation system, curriculum system, distribution of teachers, use of equipment, training fees, internship places, etc. This requires the joint participation of colleges and enterprises in the process of personnel training, and improve the training mechanism of Hydraulic engineering professionals.

3.3. Improve the evaluation system of teaching quality

Industries, enterprises, Colleges and society should participate in the analysis and evaluation of talent development. As a criterion for evaluating professionals, it can be judged according to students' professional skills, their attitude towards careers, employability and company satisfaction. By continuously improving the assessment system for the results of students' practical education, the main goal is to create an employment tracking survey system and an alumni feedback information network, to gain an in-depth understanding of students' various working abilities and comprehensive qualities through information updates and business visit surveys, and to fully listen to students' valuable opinions on school reform.^[7]

4. Pay attention to the actual effect of teaching practice and construct an effective practical teaching system of "four" platforms for Hydraulic engineering majors.

4.1. Off-campus practice platform

The College should set up an off-campus practice base. In practice, we should enhance students' understanding and understanding of professional concepts and realize the organic combination of professional theoretical knowledge and social practice. Students collect information and study by themselves, which can enhance students' confidence in mastering professional knowledge.^[8]The college should also invite technical experts from the base to the base to demonstrate for students. Through practical courses and short trips, students will be able to develop their practical and creative skills in the field of exploration, planning, design, construction and management of hydropower facilities.

4.2. Campus practice platform

Make full use of the physics laboratory, surveying and mapping experimental training center, hydraulic laboratory, geotechnical engineering laboratory, engineering geology laboratory and building materials laboratory built by the college. The laboratory is equipped with complete testing equipment to meet the needs of the water conservancy industry.^[9] The experimental equipment is also available to meet the teaching needs. The utilization rate of basic laboratory and training laboratory is more than 95%, and the utilization rate of training is very high.

4.3. Scientific and technological innovation platform

We will actively carry out innovative education activities and improve the system of innovative education and research activities in various forms, such as innovative experimental programs and public experiments. For example, the college students' extracurricular science and technology work competition "Dayu Cup". Participating in scientific and technological innovation activities, on the one hand, can enhance students' interest in learning and enable them to deepen and expand their knowledge in compulsory subjects; on the other hand, it can also promote the use of equipment and increase the level of communication and interaction between teachers and students. In addition to the above practical activities, the college also implements an innovative credit system to encourage students to voluntarily participate in extracurricular learning activities and obtain innovative credits for those with outstanding performance.

4.4. Social practice platform

The college actively promotes the establishment of a social practice platform to seek opportunities for college students to participate in social practice. With the support and guidance of teachers, students of this major not only participate in production practice and knowledge practice under professional guidance, but also actively participate in extracurricular practice activities with various forms and rich contents, such as practical training, tutoring, knowledge competition, voluntary teaching, agricultural tripartite, purchasing management, company internship and so on. Comments show that many of them give high marks to students when recruiting students in the field of Hydraulic. It is generally believed that students majoring in Hydraulic are open and active and have strong abilities of continuous learning, self-study and practice.

5. The Reform of Theory Teaching and examination method

5.1. Theoretical teaching method

At present, under the circumstances of a large number of undergraduate professional education courses and limited teaching resources, the traditional learning mode can no longer meet the needs of students' multi-directional training. According to the goal of professional certification, the teaching methods and examinations of Hydraulic engineering theory need to be reformed, focusing on solving complex engineering problems. Internet + IT combines the diversified learning platform, using heuristic and query-based theoretical teaching methods. Various organizational forms of teaching and learning are adopted, such as large group discussion, group report, etc., and process evaluation, comprehensive evaluation, group evaluation and other evaluation methods are adopted. Using international learning resources and learning platform, a comprehensive theoretical training and evaluation system has been created to cultivate students' multi-dimensional abilities. Professional education courses are taught by several teachers according to their professional characteristics. Focusing on solving complex engineering problems, the theoretical content and logic of classroom teaching aims to combine modern engineering ethics with larger engineering concepts for research-based learning. Through the introduction of inspiration and participation in discussions, a basic knowledge system for solving problems is created, which inspires basic ideas and problem-solving abilities. One example is the teaching of the course "Hydropower Plant Design". Under the guidance of the real hydropower design, the design process is divided into several modules according to the design objectives. Teachers apply heuristic teaching methods to introduce the basic principles and methods of design to students, and then divide the students into groups to successfully design each module.

5.2. Intelligence of teaching platform

Advanced learning platform. By using Internet + 's information technology, virtual reality technology and four-dimensional modeling, an online training platform for engineering structures and engineering scenes, such as 3D animation modeling system, network training system, demonstration video, virtual operation platform, etc., is developed. As well as practical engineering materials and online courses, such as engineering resume, engineering review, engineering topic expansion, etc. Integrate the three-dimensional resource platform and interactive education platform to solve students' problems. With the help of interactive learning platform, students can study independently, simulate engineering exercises and ask questions online. Teachers can realize the logical construction of online learning knowledge and discuss the engineering application in the classroom, so as to fully realize the students' leading position in learning, improve students' interest in learning and the learning effect under the inverted classroom mode.

Teaching is organized in different ways. The logical connection between basic theoretical knowledge is taught in large classes (about 80 students). Teaching in small classes (about 20 students) is conducted by professional teachers with the participation of company engineers. Students will work as a team (about 5 people each), analyze and discuss solutions to engineering problems, and present results to develop their analytical skills, engineering critical thinking skills, communication skills and management skills. The curriculum will break the original subject-based curriculum, emphasize the integrated application of basic skills, reform the curriculum structure, update the training content, explore a new curriculum model based on the progress of advanced Hydraulic technology, and emphasize the cultivation of engineering skills. Break the original "three-step" curriculum structure, which is composed of social framework, professional foundation and professional courses. The new curriculum system consists of five parts: social basic courses, professional basic courses, professional and technical courses, professional elective courses and comprehensive practical training. The above five components are interrelated and complementary. With regard to the operation of the original talent training programme, it is proposed to teach all professional courses in the sixth semester and elective courses in the seventh semester, so as to ensure the effectiveness of classroom teaching of important professional courses.

5.3. Reform of assessment mode

Reform the evaluation method. The form of single-subject examination, which is composed of graduation examination and daily homework, should be reformed, and different evaluation methods such as process examination, comprehensive examination and group examination should be adopted. It focuses on assessing the learning process and assessing students' ability to absorb and apply chapter

knowledge through subdivision and subcontinent. The share of the evaluation results should account for at least 40% of the total score in the evaluation process. Final exams should include more open-ended questions, open-ended textbooks and other forms of exams. The key point is to cultivate students' ability to comprehensively analyze professional problems and apply professional knowledge comprehensively. Team assessment is mainly conducted in the form of team reports to assess students' teamwork, coordination and communication skills, and management skills. Expand the scope of the course. Introductory courses and special lectures for pure English students have been added to the traditional courses to follow the development of international specialization. The use of well-known foreign professors to teach, foreign students to learn domestic engineering practice, domestic and foreign students to form small discussion study groups, and to organize and attend professional international conferences to cultivate students' insight. The ability to track and develop an international vision of professional international development. Thanks to the participation of world-renowned professors, alumni and industry elite representatives in group student seminars and student symposiums, it has improved the understanding and control of industrial development, the humanistic and moral qualities of students, and their overall ability to adapt to the changing international environment.

6. Conclusion

The teaching reform of Hydraulic engineering specialty has a long way to go, which is not achieved overnight, and needs long-term exploration and innovation. However, as long as we adhere to the professionalism of the training goal, the application of specialty setting, the practicality of the teaching process and the orientation of market demand, we can find a practical way to train talents in professional quality, teaching staff, practice platform, theoretical teaching and assessment methods, so as to provide the society with batch after batch of compound university talents with professional accomplishment.

References

- [1] Li Zhaoyang. *Discussion on Teaching Reform of Mechanics Course of Agricultural Water Conservancy Engineering [J]. Science Public (Science Education)*, 2019, No. 1108(04):179.
- [2] Chen Bin, Dong Yining, Zou Bing. *Teaching Reform Practice of Hydraulic Engineering Construction Based on Industry and based on project [J]. Extramural education in China*, 2009, No. 231(10):112+161.
- [3] Pang Wei, Zhang Yunqing, Lv Peng. *The reform and Exploration of Hydraulic Experiment Teaching [J]. China Science and Education Innovation Guide*, 2007, (476):54.
- [4] Meng Yanqiu, Zhang Guijin, Qin Weixing. *Research and Practice on Teaching Reform of Graduation Design of Hydraulic Engineering [J]. China Electric Power Education*, 2012, No. 256(33):71-73.
- [5] Zang Guokuan. *Analysis on Teaching Reform of Construction Technology Course of Hydraulic Engineering in Higher Vocational Colleges [J]. Scientific Consultation (Science and Technology Management)*, 2019, No. 620(01):107.
- [6] Zou Shan, Song Aihong. *Some Thoughts on the Teaching Reform of Mechanics Course for Hydraulic engineering [J]. Journal of Education Institute of Jilin Province (middle)*, 2015, 31(05):34-35. DOI: 10.16083/j.cnki.jeijp.2015.05.017.
- [7] Wei Wei, Li Yan, Cong Shizong, et al. *Research on the Theory and Practice of Teaching Reform of Introduction Course of Hydraulic Engineering [J]. Journal of Guangdong Water Conservancy and Electric Power Technical College*, 2007(02):31-33.
- [8] Fu Yanjiao. *Teaching Status and Reform Analysis of Water Conservancy Major in Higher Vocational College [J]. Intelligence*, 2017(17):4+6.
- [9] Zhang Puyang, Zhang Quan. *On the Dialectical Relationship between Classroom Teaching and Multimedia Technology [J]. Education and Modernization*, 2005, 74(1):30-33.