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Reform and Innovation of Practical Teaching Quality Assurance Based on OBE Concept

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Abstract: *In engineering education, practical teaching is an important part of talent training, which has great significance for the training of students' professional skills and the improvement of professional quality. In view of the problems existing in the process of practical teaching, such as extensive process management, high and random course performance, and insufficient interest of students in some practical teaching, guided by the " Outcomes-based Education(OBE) " concept of engineering education professional certification, this paper puts forward three measures, such as establishing a practical and operable practical teaching quality assurance system, strengthening the quality control of practical links, and assessing practical links, so as to finally realize the transformation from teachers' teaching to students' mastery, students' learning to students' use, and strive to improve the quality of practical teaching. Cultivate high-quality engineering and construction talents that meet the needs of society.*

Keywords: *Practical teaching; Outcomes-based Education; Quality assurance*

At present, China's economy and society are developing steadily, and the ecological environment has greatly improved. However, it still faces water-related problems such as water shortages, ecological damage, and environmental pollution [1], which puts forward higher requirements for the quality of hydrological personnel training. The report of the 20th National Congress of the Communist Party of China pointed out: 'Education is a national plan and a party plan. What kind of students to train, how to train students, and for whom to train students are the fundamental issues of education.' As a training unit for high-quality talents, colleges and universities are actively carrying out reforms and practices related to practical teaching to further improve the professional skills of graduates.

1. OBE concept

The concept of outcomes-based education (OBE) was proposed by Spady et al. in 1981 and then widely recognized as one of the important concepts of talent training in the United States, Britain, Canada, and other countries [2]. OBE is an educational concept with learning effects at its core. It organizes and carries out teaching activities around students' learning effects (mastery and application of knowledge), that is, it pays more attention to the teaching design, teaching content, and teaching methods in the teaching process so as to improve the quality of personnel training [3–4].

In foreign countries, 'Mind and Hand' is the core concept of practical teaching at the Massachusetts Institute of Technology; Australia often uses the actual working environment or simulated working scene as a practical teaching classroom; Canada implements the CBE (Competency-Based Education) education model and arranges practical teaching from easy to difficult [5].

The pilot project of engineering education professional certification in China began in 2006, and the pilot project of certification for the water conservancy specialty was launched in 2007. Years of practical experience in certification show that the professional certification of engineering education has promoted the renewal of the concept of water conservancy talent training, and the quality and level of talent training have also been greatly improved [1].

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The engineering education professional certification system is an important part of China's education evaluation system. 'Student-centered', 'outcomes-based education', and 'continuous improvement are the three concepts of engineering education professional certification.

2. Problems in practical teaching

Practical teaching is an important part of cultivating students' professional skills. However, in the process of practical teaching, there is still a problem of transformation from "similarity in form" to "similarity in spirit" in the requirements of professional certification of standard engineering education. In the system of "training objectives, graduation requirements, curriculum system, teaching syllabus, teaching implementation," there are still shortcomings in the last two key links, which are reflected in the following aspects:

2.1 The role change for the instructor is not in place

The division of labor of teachers in the process of practical teaching is the protagonist rather than the director, which makes most students passively accept the practical knowledge and skills taught by teachers. In the process of practice, there is less interaction and discussion between teachers and students, and students lack the opportunity to obtain relevant abilities through some creative teaching activities, which limits the improvement of students' associative thinking and innovation ability [6-7]. Traditional cramming education is still relatively common. Students are passive learners, and their participation is not high.

2.2 Practical teaching and theoretical teaching are disjointed

The purpose of practical teaching is to enable students to further understand and master the theoretical knowledge they have learned and to use the techniques and methods related to the content of practical teaching. The design of practical teaching should have a strong purpose and be closely related to relevant theoretical teaching. However, in fact, it is difficult to realize the organic combination of practical teaching content and theoretical teaching content, and even some practical teaching content is repeated, and the contradiction between practical teaching and theoretical teaching is carried out first, which is not conducive to students' in-depth understanding and grasp of the relationship between theoretical knowledge and practical knowledge [8].

2.3 Lack of support for teaching objectives

The design of practical teaching content should serve the goal of practical teaching and then support its corresponding graduation requirements index points. However, in fact, many practical teaching contents are still based on professional knowledge, and the support for teaching objectives is generally not high, such as weak support for soft power such as environment and sustainable development, individuals and teams, project management, and lifelong learning [9].

2.4 Evaluation method needs to be refined.

Due to the flexibility of its teaching methods, the practice link pays more attention to the assessment of practical teaching results, such as internship reports (course design instructions), maps, etc., while the assessment of the practice process is more extensive. It pays less attention to students' practical process and lacks guidance for students' self-awareness and improvement, which makes it difficult for a single evaluation method to accurately measure whether the practical teaching has achieved the expected effect [10–11]. At the same time, the supervision of the teacher guidance process is not in place, which further affects the practical effect.

At the'15th Anniversary Symposium of Engineering Education Accreditation for Water Conservancy Majors held in May 2023, Professor Chen Yuanfang of Hehai University pointed out that in the process of talent training, non-technical ability training and evaluation should be done well, which puts forward higher requirements for practical teaching.

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3. Practical teaching quality assurance measures

Hydrology and Water Resources Engineering of Shandong University of Science and Technology declared and approved the establishment in 2002 and began to recruit students in 2003. The specialty has graduated more than 1,000 students. Hydrology and Water Resources Engineering of our school is based in Shandong and trains professionals in hydrology and water resources for the whole country. It has formed the characteristics of paying equal attention to groundwater and surface water, taking into account the characteristics of engineering geology and environmental geology, and has also made in-depth research and attempts at practical teaching [12–16].

3.1 According to various needs, improve the teaching objectives of practical courses

Aiming at the problem that the teaching objectives of some practical courses have too much support for the graduation requirements index points, the high support is not prominent, and the lack of support for the graduation requirements index points is all dumped on the practical courses, through the questionnaire survey of graduates, enterprises, industry and enterprise experts, the requirements of employers for the practical teaching effect of hydrology students are fully judged. Organize and analyze the specific situation of practical teaching in the past, the experience and suggestions of the instructor, revise the teaching objectives of the practical course, clarify the ability requirements that students should meet, and effectively support the graduation requirements such as engineering and society, professional norms, individuals and teams, and project management. Points provide a basis for the evaluation of practical teaching effects.

3.2 Strengthen the practice link and effectively connect classroom theory and production practice

Aiming at the problem of insufficient connection between classroom theoretical teaching and practical teaching, the content of practical teaching is adjusted by analyzing and summarizing the problems in the process of practice. In the process of practice, students realize the full coverage of practical content through the actual operation of each practical link (field investigation, data collection, data collation and analysis, etc.) and effectively link classroom theory with production practice. At the same time, through mutual cooperation, communication, analysis of problems, and problem solving, students' teamwork abilities improve. For example, the practical course of " Hydrometry Practice" is to enable students to master and flexibly use the relevant knowledge of water level measurement and flowing test in the theoretical course of " Hydrological Analysis and Design " through the practical contents of the water level test of Yanhu and Ruoshuiyuan in the school and the hidden pearl river flow test outside the school.

3.3 Improve the practice evaluation criteria

In the professional certification of engineering education, the purpose of teaching evaluation is to evaluate the effect of education, provide a basis for continuous improvement, form an output-oriented work-closed loop, and continuously improve the quality of personnel training. In view of the imperfect evaluation standard of practical teaching, based on the revised and improved curriculum objectives, the practical content is adjusted. According to the curriculum objectives set by practical teaching, a clear and measurable evaluation standard is formulated, and the evaluation methods of each standard are determined. When the teacher guides the practice, the practice process ledger of each student is established to provide the basis for continuous improvement in the achievement of the course objectives.

3.4 Establish a practical teaching quality assurance system

To improve the quality of practical teaching, we must adhere to the OBE concept, establish the evaluation mechanism of practical teaching quality, the feedback mechanism of practical teaching, and the continuous improvement mechanism of practical teaching, so as to provide a guarantee for the quality of practical teaching.

3.4.1 Practice teaching quality evaluation mechanism

Evaluation of the achievement of curriculum objectives: after the end of practical teaching activities, quantitative evaluation is carried out within a limited period. According to the assessment results (practical performance, quality of results, etc.) of the students participating in the practice, quantitative

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evaluation is carried out according to the established evaluation criteria, and the achievement of various curriculum objectives is calculated and analyzed to complete the evaluation of practical teaching quality.

Teaching supervision, department leadership lectures, and evaluation: In view of the problem that the management and evaluation of practical teaching are not in place, the role of teaching supervision and department leadership in the management and evaluation of practical teaching is strengthened.

Employer evaluation: closely communicate with the employer, find out the common problems existing in the work of the graduates (such as a certain experimental principle, instrument operation ability, team cooperation consciousness, etc.), and point to some practical teaching links to complete the evaluation.

3.4.2 Practice teaching feedback mechanism

Participants include students, peer teachers, and industry and enterprise experts, respectively, from their own point of view, to provide feedback on practical teaching. In the last link of practical teaching, students report the practical gains and, at the same time, put forward the shortcomings of the instructors in practical knowledge explanation, practical content guidance, practical effect, and so on. Instructors review students' practical results (internship reports, course design specifications, etc.), summarize the experience of guiding practical teaching, and propose continuous improvement measures. In a certain period of time, peer teachers and industry and enterprise experts are invited to comment on the practical content, practical process guidance, and other aspects and put forward opinions and suggestions. Detailed feedback and discussion records are kept in all aspects.

3.4.3 The continuous improvement mechanism of practical teaching

This paper analyzes the achievement of each course goal in practical teaching, combines the results of teaching supervision, department leaders' lectures, and evaluation, and aims at the problem of low achievement of course objectives. By optimizing the practical content, changing the practical teaching mode, improving the practical teaching conditions, and other ways, we will improve the teaching activities in the next cycle.

4. Conclusion

In August 2001, the Ministry of Education put forward “Further strengthen the practice teaching, pay attention to the cultivation of students' innovative spirit and practical ability " in "Opinions on Strengthening Undergraduate Teaching in Colleges and Universities to Improve Teaching Quality." On July 10, 2019, the Ministry of Education issued "Opinions on Strengthening and Regulating the Practice Management of Ordinary Undergraduate Colleges and Universities." Its essence is to help students learn to solve complex engineering problems through the transformation from theoretical knowledge to professional skills.

In the process of talent training, theoretical teaching and practical teaching are complementary and indispensable. Through practice, students can deepen their understanding of the theory and improve their ability to use the theory to analyze and solve complex engineering problems. By establishing and strengthening the reform of practical teaching quality assurance, strengthening the cultivation of professional ideological education, and developing the ability to solve complex engineering problems in a diversified way, students can experience the importance of their major, enhance their enthusiasm and initiative in learning, and then learn real skills, which is important content to improve the quality of practical teaching.

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