

Exploration and Research on Teaching Reform of "Subgrade and Foundation Engineering Technology" Course Based on CDIO Teaching Concept

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Abstract: "Subgrade and Foundation Engineering Technology" is a professional core course of civil engineering. In the post-epidemic era, we should think about how to break through the traditional "injection" classroom teaching method, innovate the classroom teaching mode and process evaluation system. It is particularly necessary to study all-time and space. According to the core concept of CDIO teaching mode, on the basis of industry, enterprise and job adaptability for talents' core competency requirements, the course objectives and positioning are analyzed, combined with the current events and hot events that students are concerned about, from "result-oriented", "student-centered" and "student-centered" "Continuous improvement" and other aspects, re-integrate the course teaching content, expand diversified teaching methods, build a multi-dimensional and multi-channel learning path for theoretical and practical knowledge, and a whole-process assessment system. A series of reforms and practices based on course teaching It helps to broaden the teaching time and space, strengthen the cultivation of students' comprehensive quality and ability, and also has certain reference significance for the teaching reform of related courses.

1. Introduction

The development of science and technology promotes the transformation and upgrading of national industries. Driven by the wave of supply-side reform and forced by market demand, it is imperative to provide high-quality skilled talents with a reasonable structure. This further prompts us to think about how to reform the traditional teaching mode under the new situation to meet the requirements of the development of the times for the core competence of talents. Coupled with the resurgence of the epidemic, how to reform traditional teaching methods and means, provide multi-dimensional, multi-channel and multi-channel learning paths and a scientific and reasonable assessment and evaluation system to meet students' demands for knowledge learning, as well as industries and enterprises for talents' professional quality and professional ability demand is an urgent problem that needs to be solved at present. This paper takes the course "Foundation and Basic Engineering Technology" as an example, under the guidance of the CDIO^[1] teaching model concept, supported by the visiting engineer project, and reintegrates the teaching content by

investigating the professional quality requirements of talents in industries, enterprises and positions, relying on engineering cases closely integrated with engineering practice to strengthen students' practical ability ^[2]. In terms of teaching mode, based on "result-oriented", "student-centered" and "continuous improvement concept", some thinking and exploration have been made, and a series of teaching reforms and practices have been carried out. It has certain reference significance ^[3].

2. Problems Faced By the Course Teaching of "Subgrade and Foundation Engineering Technology"

2.1. Theorization of Teaching Content

At present, the teaching content of "Foundation and Basic Engineering Technology" is too outdated, and the introduction of cutting-edge engineering technology methods and methods for foundation and basic engineering is too little, and it is seriously derailed from engineering practice. In view of the academic conditions of higher vocational colleges, compared with the training objectives of higher vocational talents, the teaching content is more theoretical, which does not match the occupational needs of enterprises for specific levels of talents, resulting in the lack of understanding of the knowledge learned by the trained talents ^[4]. Thorough, unable to truly grasp its main points, it is difficult to achieve zero docking of students from school to work.

2.2. The Practical Teaching Content Is Too Small, Derailing From the Actual Engineering Practice

The practical teaching content of "Foundation and Foundation Engineering Technology" only involves the measurement of the three-phase system index of soil, which is far from the practical ability requirements required for engineering practice. For the construction of foundation treatment and basic engineering, it is difficult to complete the relevant training tasks in the teaching and training site, so that it is difficult for students to understand the abstract teaching content, resulting in the inequity between the teaching content and the information input and output in the teaching that students grasp ^[5]. The cultivation of students' comprehensive quality ability, such as analyzing and solving practical problems, is far from meeting the needs of enterprises for professional and professional quality of talents.

2.3. The Teaching Assessment and Evaluation System Is Not Perfect

For the current "Foundation and Basic Engineering Technology" course, the students' teaching assessment and evaluation are still mainly based on the assessment of theoretical knowledge, but for the course "Foundation and Basic Engineering Technology", it has high requirements for students' professional practical ability, the assessment of theoretical knowledge is difficult to comprehensively evaluate students' mastery of the professional knowledge they have learned, and there is no good evaluation and feedback mechanism for students' classroom teaching effect, and it is impossible to track students' learning status in time, resulting in the failure to achieve a good connection between students' mastery of knowledge and teachers' expectations ^[6].

3. Teaching Reform of Foundation and Foundation Engineering Technology Course Based on CDIO Teaching Concept

The teaching reform model of the Foundation and Foundation Engineering Technology course based on the CDIO (Conceive, Design, Implement and Operate) engineering education model, re-

integrate the project-oriented and project-based teaching content, Combine the theoretical knowledge with the objectives and processes of project-based teaching, focus on cultivating students' engineering thinking, improve their ability to solve and analyze problems independently, and enhance their awareness of innovation. With the rapid development of mobile Internet, virtual simulation (VR) and MR technology are gradually sinking into the education industry, and multi-dimensional and multi-channel learning paths and teaching methods are constructed in the post-epidemic era ^[7]. "Results-oriented", establish and improve the comprehensive evaluation system based on the learning process, combine the industry and enterprise's demand for the core competence of talents, multi-angle and multi-directional evaluation of learning results.

3.1. Reform of Teaching Content

3.1.1. Practical Teaching Content

By visiting the engineer project, we collected first-hand teaching resources and materials and fed them back into classroom teaching. In the teaching system of higher vocational education, we should grasp the teaching objectives and positioning of the course, use case teaching, and impart knowledge points to students in a teaching method closer to the actual project in a simple and understandable way ^[8]. With students as the main body, let students understand the current situation of domestic technology development and the problems existing in the current industry and enterprises. In combination with current events, learn about the hot news of students' concern and the current hot news and engineering cases of major projects. Combine some important and complex problems of soil mechanics and foundation and the ideas and methods to solve these problems with vivid images, strengthen the mastery and understanding of the curriculum and subject frontier engineering technology, and realize the direct docking with the development of modern science and technology. Into curricula education related elements, targeted to introduce some important engineering accidents and involved in the courses of theory and practice, deepen the students' sensory experience and intuitive understanding, more conducive to deepen their understanding and impression of such problems, stimulate students' sense of social responsibility, improve learning initiative and interest ^[9].

3.1.2. Innovative Teaching Content

In the selection of teaching content, it is necessary to introduce the current development trend of academic frontier according to the development trend of current industry and profession, keep up with the latest research results and technologies of professional development. According to the current problems faced by the development of the industry, through the teaching method of throwing a brick to attract a gem, let students actively explain their understanding and views on the problem, cultivate students' independent thinking and innovation consciousness, improve students' interest in learning, and enhance the ability to apply the theoretical learning to engineering practice. In teaching, experts are invited to give lectures through the teaching model of "bring in, go out" to improve students' grasp of the industry dynamics. Actively promote the reading of the latest cutting-edge professional books and exchange seminars and other interactive communication methods, strengthen students' grasp of knowledge and understanding of the latest development of relatively mature new technologies, new materials and new processes in the field of professional expertise, so that students can broaden their horizons, broaden their knowledge, and stimulate their creativity.

3.1.3. Integration of Teaching Content

Breaking the decentralized teaching mode of traditional theoretical knowledge points, in the

form of engineering cases, the involved knowledge points are comprehensively summarized, so that students can better grasp the knowledge through the "why to learn" point. Pay attention to the cultivation of students' overall quality and comprehensive ability, strengthen students' ability to acquire knowledge, analyze and solve problems, and strengthen the teaching and training of comprehensive engineering design. At the same time, according to the current society's requirements and needs for "slash talents", in teaching, the interdisciplinary and integration of disciplines is reflected, the professional ability and professional quality of students are improved, and the basic professional moral quality including humanities, society, and management science is strengthened. Cultivation, to achieve zero docking of students from school to work.

3.2. Reform of Teaching Methods

3.2.1. Carry Out Research-Based Teaching

By carrying out discussion-based teaching, publishing research and discussion questions through online teaching platforms, students collecting materials offline, discussing speeches, adding self-assessment, mutual assessment and teacher comments links, expand students' autonomous learning and mastery of knowledge, and fully mobilize students' learning ability. Positivity and initiative, and planned to cultivate students' ability to solve problems independently and a sense of innovation. Conduct extensive discussions on the current events and hot news related to the course, and listen to the understanding and analysis of current engineering current events and hot events from all parties, which will help to cultivate students' ability to use the knowledge they have learned to solve practical engineering problems and strengthen analysis of problems. The cultivation of ability, broaden the comprehensiveness and thinking of students' learning knowledge.

3.2.2. Set up a Second Class

To carry out multi-channel multi-dimensional learning path, by setting up the second classroom, invite academic experts and scholars to do academic report and engineering technology lectures, strengthen the students' interest in learning this course, and through such lectures, cultivate the students' engineering thinking, broaden the professional field of vision, strengthen the understanding and mastering of knowledge, Understand the existing problems and solutions of major geotechnical engineering construction in China, and understand the window of subject frontier. Students are required to read a certain amount of literature, and carry out regular reading and exchange activities, promote students to think independently, ask questions, answer questions, cultivate independent learning ability and learn from each other, stimulate students' potential.

3.3. Reform of Teaching Evaluation System

The course assessment and evaluation system adopts procedural assessment. In the post-epidemic era, through multi-dimensional and multi-channel learning methods, to ensure the smooth achievement of course teaching objectives and the real-time tracking of students' learning dynamics, it is necessary to establish a sound and complete system that meets the needs of the industry and enterprises. The whole-process assessment and evaluation system of talent core competency requirements^[10]. The assessment content is divided into four categories according to the learning process: basic type (mainly reviewing book knowledge), comprehensive design type, engineering practice type, and innovative research type. Students can discuss and solve problems collectively by project teams. The principle of performance evaluation is based on knowledge. The "rationality" of the application is mainly used, that is, students should be able to give reasons to explain the rationality of their design, and have appropriate analysis and speculation, based on students' actual

performance and work results, including project implementation results (R&D reports and Its presentation) accounted for 40%, and the seminar teaching and learning process accounted for 60% (including literature reading, hands-on ability, teamwork ability, problem-solving ability, rationality and innovation of design and craftsmanship). Through the improved teaching assessment and evaluation system, it is possible to track and feedback students' learning results in a timely manner, so as to assess and evaluate students' comprehensive quality and ability, thereby cultivating students' ability to analyze and solve problems creatively.

4. Conclusion

Under the background of curriculum revolution, the practical dilemmas and problems in the teaching of Foundation and Foundation Engineering Technology are sorted out. Through the teaching concept based on CDIO, the teaching content of course is reformed. Select the teaching focus in a way that is close to the actual project. By combining the original scattered teaching knowledge points with engineering cases, students can better grasp and understand it as a whole. Set up the second classroom which is a new reform teaching means and methods. Through the multi-angle, multi-dimensional and multi-channel learning path, actively enhance students' ability to analyze problems and innovation consciousness which can broaden professional horizon, cultivate engineering thinking and professional quality. Improve the course teaching assessment system and mechanism, establish a complete whole process assessment and evaluation system to meet the needs of industries and enterprises for the core competence of talents. Tracking the teaching effect of class can achieve the purpose of process control. Based on this, the teaching content and teaching methods are further updated and adjusted. Under the background of "golden curriculum" created by the Ministry of Education, the reform system of curriculum education should be improved. It is committed to training engineering construction talents who match with modern engineering practice, have practical and innovative ability, and meet the professional needs of the industry and enterprises for talents.

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References

- [1] Zhang Long. (2012) *Teaching Reform of Soil Mechanics Course Based on CDIO*. *Science and Technology Information* 32: 154-155.
- [2] Zhao xi, Lou Yongzhong, Zhao Jie. (2020) *The Reform and Practice on the Course of 'Soil Mechanics and Foundation Engineering' Based on IEET Engineering Certification*. *Journal of Hubei Open Vocational College*, 33 (11): 140-141.
- [3] Chen Wenjie, Ren Lijun, Zhang Lin, Yang Feng. (2009) *Project teaching reform based on CDIO mode in Singapore Institute of Technology*. *Vocational and Technical Education*, 30 (35): 91-93.
- [4] Gu Peihua, Shen Minfen, Li Shengping et al. (2008) *From CDIO to EIP-CDIO—Exploration of Engineering Education and Talent Training Mode in Shantou University*. *Higher Engineering Education Research*, 1: 12-20.
- [5] Jiang Yantao, Zhao Shiqi, Yang Yi. (2018) *Discussion on Curriculum System and Teaching Evaluation of Environmental Construction Major under IEET Engineering Certification*. *Journal of refrigeration*, 37 (3): 71-77.
- [6] Zhu Jiadong, Qiao Haiye, Huang Yan. (2018) *Discussion on Innovation and Entrepreneurship Education in Higher Vocational Colleges under IEET Technology Education Certification Paradigm*. *Education modernization*, 5 (43): 46-50.
- [7] Duan Xiongchun. (2017) *Investigation and Enlightenment of Engineering Education Certification in Taiwan*. *Forum on Vocational Education*, 12: 92-96.
- [8] Gao DA Zhao. (2006) *Soil Mechanics Teaching and Civil Engineering Generalist Education*. *Proceedings of the*

First National Symposium on Soil Mechanics Teaching. People's Communication Society, 1: 16-21.

[9] Jia Caihong, Cao Yun. (2013) *Teaching reform and practice of soil mechanics based on CDIO concept. Shandong Industrial Technology, 12: 13-14.*

[10] Liang Qiao, Zou Hongbo, Liu Jie. (2021) *Practice of online-offline hybrid teaching reform: A Case study of "Soil Mechanics and Foundation" course. Education and Teaching Forum, 11: 69-72.*