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Original Paper

The Research on Teaching Reform of Civil Engineering Construction Course Based on Rich Practical Teaching

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Abstract

As a comprehensive, practical, and timely course, the Civil Engineering Construction course requires university teachers to possess systematic theoretical knowledge and practical engineering experience. Therefore, universities need to establish a "dual-qualified" teaching team through industry-academic collaboration. This paper focuses on the Civil Engineering Construction course at Qingdao City College, collaborating with Zhongqing Jian'an Construction Group Co., Ltd., to discuss the model of school-enterprise cooperation and the understanding of curriculum reform oriented towards practical teaching. This paper highlights the significant contribution of strong collaboration between schools and enterprises in practical teaching to improving the quality of talent cultivation in the civil engineering profession. Based on the educational research projects at Qingdao City College, it primarily investigates the expansion of school-enterprise cooperation forms, the development of industry-academic-research project collaborations, the exploration of new models for curriculum design guidance, the construction of a reasonable and comprehensive teaching system for green construction courses, and the innovation of teaching methods.

Keywords

Civil Engineering Construction, Practicality, Curriculum Reform

1. Background of the Research Topic

1.1 Order-Based Training for "Cultivating High-Quality Creative Talents"

Order-based training refers to the agreements signed between enterprises and schools regarding talent cultivation needs, where enterprises arrange employment for students according to the terms of the agreement. This model has a clear employment purpose and fosters close connections between schools and enterprises. All three parties—schools, enterprises, and students—benefit from this arrangement. In order-based training, all three parties must sign an agreement, which clarifies the rights and obligations of each. For the school, the focus is on helping students acquire practical operational skills through simulated internships and on-the-job training. The enterprises specify their hiring needs and standards, and the school trains students accordingly. Ultimately, both the school and the enterprise assess the students, allowing qualified students to secure employment within the company.

1.2 Work-Study Integration Model Maximizing Student Participation under Teacher Guidance

The work-study integration talent cultivation model emphasizes joint efforts by schools and enterprises to guide students. It combines the professional knowledge and practical skills learned in school with real-world work experiences in enterprises, providing strong conditions for students' future employment. Teachers should utilize their positions to guide and stimulate students' desire for knowledge and interest in learning. For example, they might present a real problem related to a project near the school or reflect on how earthquakes impact the design and construction quality of buildings. Teachers should provide ideas without giving answers, encouraging students to visit, understand, and research extensively before engaging in thorough discussions and expressing their opinions. Finally, the teacher will analyze the outcomes. In this process, the teacher acts as an observer rather than a judge, motivating students and maximizing their active role in learning.

2. The Significance of the Topic Research and the Research Ideas

2.1 Significance of the Research Topic

This research aims to cultivate applied talents at the undergraduate level in civil engineering, specifically focusing on developing civil professionals who "understand construction management methods". Currently, new projects and cities consume vast amounts of natural resources and energy, and the government is increasingly strengthening its efforts in environmental governance. The construction industry is a key focus of national governance. However, there is a significant shortage of talents who truly grasp the application of construction management methods. This research is meaningful as it aims to establish a practical, construction-oriented curriculum system in civil engineering, thereby cultivating new management talents that align with national policy requirements.

2.2 Effective School-Enterprise Cooperation

By adopting a model of "collaborative research on training programs, collaborative development of teaching resources, collaborative teaching, and collaborative employment", we can effectively achieve school-enterprise cooperation. This approach aims to cultivate applied technical and skill-based talents, enhancing students' employability and entrepreneurial capabilities. It provides enterprises with new composite application talents and improves the employment rate of our students, thereby establishing our school as a brand in specialized fields.

2.3 Enhancing Teachers' Practical and Innovative Skills

Through the school-enterprise cooperation model, our teachers can immerse themselves in enterprises and on-site operations, gaining insights into advanced construction technologies and scientific management methods used in actual construction. This experience significantly enhances teachers' practical skills. During the curriculum reform process, our teachers continuously explore new teaching methods and techniques, thereby improving their innovative capabilities.

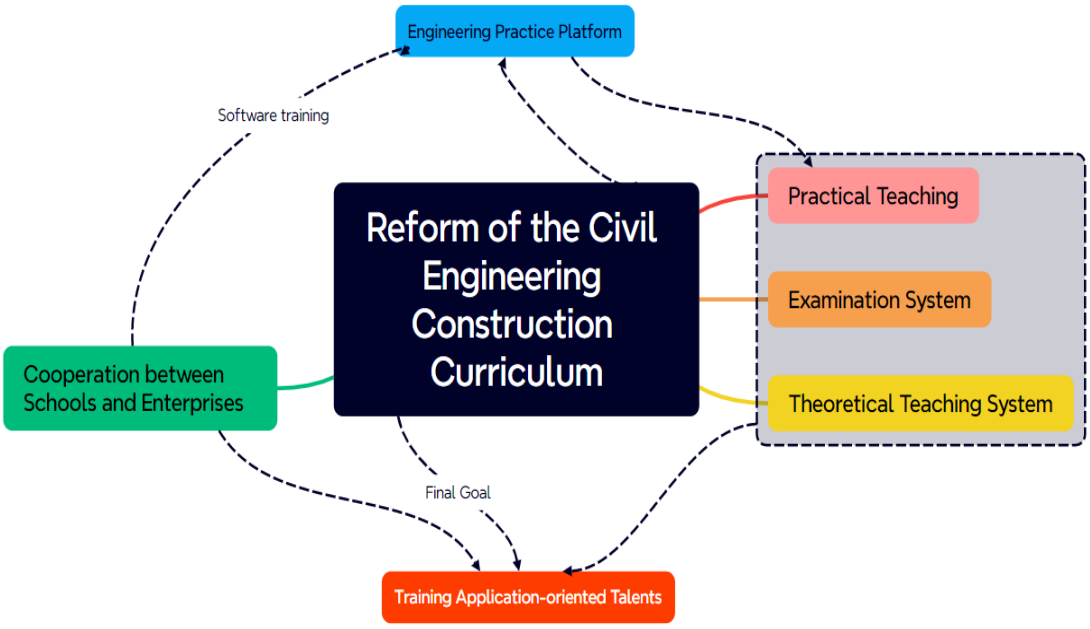

Figure 1. Translation: Research Ideas for the Topic

3. Education and Teaching Project Development and Completion Status

The entire project's progress plan and goals are divided into three phases:

Phase One: September 2019-March 2020: This phase involved formulating the research plan for the reform and practice of civil engineering construction teaching.

Phase Two: April 2020-March 2021: In this phase, the implementation plan was carried out, which included extensive reading of theoretical works, conducting surveys, collecting materials, and writing papers.

Phase Three: April 2021-September 2021: This phase focused on organizing materials, writing papers, final reports, and applying results.

In April 2020, the project team members began to implement the plan and collect materials. During this phase of concrete work, two preparatory actions were particularly emphasized:

3.1 Purchase of Theoretical Books

One-quarter of the educational reform funding was allocated to acquire various theoretical books. The team members committed to thorough reading of these texts to enhance their theoretical knowledge and understanding, which would support the research of the project.

3.2 Conducting Surveys

The project team undertook a series of surveys to reference and learn from the successful experiences of others in the field. This effort not only enriched their understanding but also strengthened external connections, laying the groundwork for the practical implementation of reforms. These preparatory steps aimed to ensure a solid foundation for the subsequent phases of the project, enabling the team to effectively apply the insights gained in their curriculum and teaching practices.

From September 2021 to the present, the research team's previous findings have been applied in the teaching of the "Civil Engineering Construction" course.

4. Major Reform Achievements and Practical Effects of Educational Teaching Projects

Since April 2020, the research team members have actively engaged in research work. The team is responsible for the reform research of the teaching practice component, specifically applicable to the revision of the teaching plan. In the teaching plans for the 2018 and 2019 cohorts in civil engineering construction, the requirement to use construction management software has been strengthened in the practical teaching component—namely, in course design. The main members of the research team have incorporated more practical construction teaching content into the theoretical teaching of civil engineering construction, utilizing multimedia teaching methods such as presentations and videos to enhance students' understanding of construction concepts. The collaboration between the school and industry is mainly achieved through the "One Course, Two Teachers" model, where external mentors introduce students to the necessity of construction in real engineering projects.

The main classes discussed in this article are Engineering Management and Civil Engineering. In the course design for these two majors, construction management-related software has been utilized to create a three-dimensional simulation layout of the project's site plan. The schedule control has employed a time-scaled network plan for dynamic progress control. During the preparation of the construction plan, software calculations have been used for temporary water and electricity usage, reflecting the green energy-saving requirements in construction. Student feedback has been positive, indicating that they can effectively connect theory with practice.

5. Features and Innovations in the Reform of Civil Engineering Construction Courses

In the teaching of civil engineering construction courses, we integrate construction skills training with safety management education, primarily using case-based teaching to cultivate students' systematic understanding of engineering project construction. This is also a direction for the blended teaching of the course, with both online and offline components. The course includes numerous discussion sessions to stimulate students' interest in learning.

In response to the characteristics of the course and existing teaching issues, the research team studied the specific construction measures of top undergraduate courses in domestic universities. They collected feedback from the industry regarding the knowledge base and technical skills required for practical construction talents, as well as the demands from enterprises regarding students' capabilities. The team believes that the blended course construction should focus on the following aspects.

5.1 Optimize Course Teaching Objectives

The civil engineering construction course has applied for the development of a university-level top-tier course. Taking advantage of the opportunity provided by the construction of top undergraduate programs, it aims to strengthen the collaboration between the university and enterprises. This involves inviting experienced personnel from large construction companies to teach on campus, establishing a fixed model for this collaboration.

Through feedback from these enterprises, we will optimize the teaching objectives of the course, ensuring that the concept of green construction is deeply ingrained in students' understanding. Actual engineering cases from the companies will be used as teaching content to clarify and emphasize key knowledge points, optimizing students' knowledge structure and forming a balanced knowledge system that integrates both technical and management aspects.

5.2 Increase Extracurricular Interest Experiment Sessions

With the opportunity of integrating on-campus resources for the development of top undergraduate programs, we should encourage students to participate in extracurricular interest experiments. Students can collaborate with teachers to independently conduct some practical experiments related to foundational construction practices, such as concrete performance testing, to enhance their

understanding of construction concepts and to select more environmentally friendly materials and advanced technologies.

Additionally, teachers should incorporate ideological and political education into the course to enhance students' professional identity and vocational quality. This will help form intrinsic motivation and stimulate students' interest in independent learning.

5.3 Enrich Online Teaching Resources

Establish a course resource database that provides ample engineering case studies, diversifies the types of resources, and enhances student engagement in learning. Include review questions to reinforce students' retention and understanding of textbook knowledge, thereby laying a solid foundation for promoting the course as a quality course and a top undergraduate program.

5.4 Enhance Teachers' Engineering and Teaching Abilities

Teachers can apply to the college for opportunities to work in enterprises during their free periods, thereby increasing their engineering experience. This will enable them to fully grasp management techniques for construction, as well as methods for process control and quality control. They will also understand the substantial differences in detail handling between new methods, new techniques, and traditional construction practices.

5.5 Reform Teaching Methods and Approaches

In 2020, the online teaching model was widely implemented, revealing significant deficiencies in the online teaching skills and proficiency of instructors. To address this, teachers in the research group should participate in network teaching training organized by the school. They need to become proficient in using more than one online teaching software, learn to upload teaching materials to the Chaoxing teaching platform, and conduct online classes.

In terms of teaching methods, there is a strong effort to change traditional teaching approaches, update course content, and adopt teaching methods that emphasize the cultivation of engineering practical skills, such as inquiry-based, discussion-oriented, self-directed, problem-based, and practical approaches. The aim is to enhance the dynamism, engagement, and interactivity of classes while promptly summarizing teaching experiences to feed back into classroom instruction, thereby forming a continuous course improvement model.

6. The Level of Achievements in the Reform of Civil Engineering Construction Courses and Their Practical Application Value

In the process of conducting research and experimental practices, there will certainly be some specific practical outcomes. Although these are not the direct results of the research, they can be included in the analysis of practical outcomes or impact of results in the final report. These practical effects of research typically include the following aspects:

Student Level: There has been a significant increase in students' interest in learning, an enhancement in their self-directed learning abilities, and an improvement in their proficiency with construction management-related software. The practical aspect has been strengthened, and students' problem-solving skills have also improved.

Teacher Level: Through the implementation of this project, teachers' research and teaching levels have improved, their practical skills have been strengthened, and their research capabilities have been enhanced.

School Level: The results have been promoted within the Civil Engineering and Engineering Management programs. The teaching quality of civil engineering construction courses has improved, and students' grades are generally better, reflecting the unique characteristics of the college.

Societal Level: The project aligns with the national green energy-saving policy and represents the direction for future development in construction engineering.

The distinctive feature of this project lies in how to stimulate students' enthusiasm by utilizing various teaching methods and strategies to comprehensively enhance the quality and effectiveness of the course instruction.

7. Conclusion

Through the implementation of the Civil Engineering Construction course, the teaching team has reformed and adjusted the teaching content and syllabus. The curriculum now includes teaching on construction, integrating real engineering site situations and case analyses to elucidate the purpose and significance of construction practices.

By improving teaching methods and utilizing construction management software, the classroom experience has become richer, more dynamic, vivid, intuitive, and easier to understand. This significant enhancement in the information provided effectively alleviates the challenges posed by reduced class hours and increased teaching content, resulting in better teaching outcomes.

Moreover, practical teaching has been strengthened, with innovative course design being developed. The course design emphasizes students' ability to use construction management software, reflecting their central role in the learning process. It focuses on cultivating engineering practice skills, problem analysis and resolution abilities, and a rigorous work ethic. This approach better achieves the goal of

linking theory with practice, encouraging students to identify, think about, and solve problems. Consequently, it has been well-received by the students.

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