

# Thoughts on Innovative Teaching of Civil Engineering Undergraduate Based on CDIO Engineering Education Mode<sup>1</sup>

Bing Liu

Guilin University of Technology Guilin 541006

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**Abstract:** In the current situation of new engineering, the undergraduate teaching of civil engineering also needs a series of innovations to meet the requirements of the development of the times. All walks of life in China are talking about innovation. Every discipline in colleges and universities is striving for innovation, and civil engineering is no exception. Therefore, civil engineering needs to strengthen the cultivation of undergraduate students' innovation ability. Based on the CDIO engineering education model, this paper expounds the goal and realization path of innovative teaching of civil engineering undergraduate.

**Keywords:** Civil engineering; Engineering education mode; Innovative teaching

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## 1. Introduction

Since 2000, several universities in developed regions in Europe and the United States have received a subsidy of 20 million US dollars from the Knut and Alice Wallenberg Foundation. After four years of exploration, they have created the CDIO engineering education concept. At the beginning of the 21st century, 20 million US dollars was a very large sum of money invested in the research of educational concepts. China's research on educational concepts was still at the beginning of a period of rapid development, which reflected that China did not pay enough attention to the research of educational concepts in this period.

CDIO is the abbreviation of Conceive, Design, Implement and Operate. These four words correspond to the idea, design, implementation and operation respectively. It is the life cycle of the product from initial creation to final realization, which corresponds to the education and training mode of civil engineering from the initial learning stage of students to the ability to solve practical engineering application problems in all aspects. By taking CDIO engineering education mode as the carrier, engineering education is brought into its mode, which can be summarized as guiding students' learning attitude from passive to active, and embodied in daily learning and discipline experiment and exploration, while realizing the learning method of organically linking practice with curriculum. Based on the CDIO mode, the undergraduate education of civil engineering is divided into four levels: personal ability, basic engineering knowledge, engineering system ability, and team cooperation ability, so as to cultivate students to become excellent comprehensive talents at four levels. The author combines CDIO engineering education mode to discuss the innovative teaching of civil engineering undergraduate.

## 2. Main Objectives of Innovative Teaching for Civil Engineering Undergraduate

### 2.1 Cultivate top innovative talents in civil engineering

In the innovative teaching of civil engineering undergraduate courses, we should scientifically and clearly formulate

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<sup>1</sup> **Fund project:** This paper is the research result of the key project of Guangxi Higher Education Undergraduate Teaching Reform Project "Construction and Practice of Innovation Ability Training Mode for Civil Engineering Students" (No. 2021JGZ124), and also supported by the National Natural Science Foundation Youth Fund (52108201), Guangxi Natural Science Foundation Youth Fund (2021GXNSFBA220049), Guangxi Science and Technology Base and Talent Project (Guangxi AD22035999) and other projects.

teaching objectives and talent training programs, and determine that the main goal of discipline training is to cultivate the top innovative talents of the discipline. In order to cultivate students' innovation ability, a series of teaching reforms are needed, which is different from the traditional teaching mode. The new teaching mode requires that students' ideas should be transformed from passive acceptance of the results to a new active exploration process inspired by CDIO, and students' innovative thinking and divergent ability should be fully mobilized in teaching. Therefore, students should have more opportunities to participate in scientific research, Allocate more teaching and scientific research resources to undergraduate students, cultivate their practical and innovative thinking ability at the current stage, achieve innovation in the process of practice, improve the overall quality of undergraduate students in the combination of theoretical knowledge and innovation ability, and promote the absorption of more perfect and high-quality students to achieve a virtuous circle. Through the customized training program for top-notch innovative talents in civil engineering for students, a training platform for innovative top-notch talents with its own characteristics and in line with the development of civil engineering students in this university will be formed, so that students can have a good professional quality of civil engineering undergraduates, be familiar with basic theories, focus on improving students' practical ability and innovative design ability, help students train their scientific research thinking, strengthen students and students, students and teachers The mutual communication between teachers can improve the professional comprehensive quality of undergraduate students in an all-round way.

### **3. The Path to Realize Innovative Teaching of Civil Engineering Undergraduate**

#### **3.1 Improvement of teaching mode**

Because the traditional teaching mode lacks the combination of theoretical knowledge learned into actual teaching, classroom experiments are all from textbook knowledge to simple practical verification, which are stuck on the surface of knowledge without in-depth research and learning, resulting in less knowledge gained by students, no broadening of their own thinking, and lack of the ability to innovate. In the innovative teaching practice of civil engineering undergraduate course, it is necessary to improve the traditional teaching mode, build an innovative curriculum teaching mode, and focus on cultivating students' scientific research thinking and innovative thinking. Traditional civil engineering teaching pays more attention to theoretical teaching, but lacks experimental teaching and scientific research training. It needs the cooperation of teachers' teaching mode improvement and college curriculum teaching mode improvement. In the civil engineering discipline, the theory course in the undergraduate course teaching system is to lay a good professional foundation. The experimental course is mainly to verify the important theories in the theory course. The students only need to practice and lack the understanding of experimental methods. The thinking after practice is not paid enough attention, and the best effect of the experimental course in cultivating students' innovative thinking and scientific research thinking is not achieved. Therefore, more efforts should be paid to the teaching mode.

For example, experiments are interspersed in theory courses. After finishing an important part of a professional course, this part of the experiment is carried out immediately. After finishing the theory course, the experiment is to enable students to have a certain professional knowledge as the basis for more thinking about the experiment. Experiments are used to consolidate students' knowledge, train students' scientific research thinking, let students participate in the experiment design independently, and achieve the training of students' innovative thinking. The purpose of interspersed experiments in the course is to enable students to understand the origin of theoretical knowledge and consolidate knowledge. Students should put forward corresponding problems according to the experimental content, and think about and explore the problems and propose corresponding solutions. In the classroom teaching, students should not stay on the surface of doing experiments, but do not study doing experiments deeply. If such a teaching mode is carried out, it is a failure and has no meaning. Therefore, when conducting experiments, we should look for the shortcomings of the experiment and find solutions, which is conducive to cultivating students' ability to innovate, think and explore knowledge.

#### **3.2 Combination of scientific research projects and teaching**

Scientific research is a good way to cultivate undergraduates' innovative spirit and practical ability. Through participating in scientific research projects, we can preliminarily master the methods of scientific research and lay a foundation for future exploration and innovation on the academic road. In addition, by participating in scientific research projects, students broaden their horizons and ideas. The organic combination of scientific research projects and undergraduate teaching is an effective way to improve students' innovative thinking and scientific research thinking, and to cultivate top-notch civil engineering talents. After the theoretical courses and experimental courses, undergraduates have a certain professional theoretical foundation, can

understand the purpose of each experimental arrangement in scientific research projects, can think about scientific research projects, and cultivate the ability of independent thinking. In the undergraduate teaching stage, most of the experiments are repeated experiments of textbook knowledge content, which can meet the needs of students to explore professional knowledge, but can not meet the requirements of students' scientific research thinking and innovative thinking training. However, in the current form of higher education in China, it is impossible to meet the requirements of arranging a teacher for each student to guide, so we should combine scientific research projects with undergraduate teaching, Provide more and more adequate ways for students' scientific research training and practical training, so that students have more opportunities to participate in scientific research and experience scientific research. The combination of scientific research projects and undergraduate teaching will open more learning space for students.

## 4. Conclusion

Cultivating undergraduates' innovation ability is the top priority of innovative teaching of civil engineering undergraduates based on CDIO engineering education mode. All attempts and explorations that contribute to the cultivation of undergraduates' innovation ability should be actively encouraged and fully affirmed. In undergraduate teaching, we should pay attention to cultivating students' innovative thinking and scientific research thinking, so that the innovative ability of undergraduate students can be gradually improved unconsciously with the influence of undergraduate innovative education, and meet the requirements of top talents in civil engineering.

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