Global Research in Higher Education
ISSN 2576-196X (Print) ISSN 2576-1951 (Online)
Vol. 8, No. 2, 2025
www.scholink.org/ojs/index.php/grhe

Original Paper

Exploring the Teaching Reform of Civil Engineering Construction

Song Ming-zhi[1*], Zhao Yuan-yuan[2] & Liu Yang[1]

[1] Intelligent Construction Department, Qingdao City University, Qingdao, China

[2] Department of Accounting and Finance, Qingdao City University, Qingdao, China

[*] Song Ming-zhi, E-mail: 1207483490@qq.com

Received: May 12, 2025 Accepted: May 21, 2025 Online Published: May 26, 2025

doi:10.22158/grhe.v8n2p35 URL:http://dx.doi.org/10.22158/grhe.v8n2p35

Abstract

In this paper, for the current "civil engineering construction" course teaching process exists in the theory from practice, knowledge fragmentation and insufficient student participation and other issues, from the perspective of teaching content, teaching methods, etc. put forward a few suggestions for peer reference.

Keywords

Civil engineering construction, teaching reform, practical skills

Under the background of new engineering, the talent cultivation objectives of applied local universities are more specific and pay more attention to the ability to find problems, analyze problems and solve problems (Zhang, L., Zhang, W., & Gao, Banana, 2022, pp. 234-235, p. 243). As a core course of civil engineering, Civil Engineering Construction is the foundation for students to study subsequent specialized courses and to engage in design, construction and other related work in the civil construction industry after graduation (Li, J., Cai, K. K., & Wen, S. D., 2017, pp. 131-133). The knowledge structure of the course contains two major course modules: building construction technology and building construction organization. The former systematically analyzes the construction process and control elements of sub-part projects; the latter covers the basic principles of construction organization design, network planning technology and flow construction. Currently, there is a common problem of theory being detached from practice in teaching, which seriously restricts the cultivation of students' engineering practical ability. The purpose of this paper is to explore the teaching content and teaching methods of the Civil Engineering Construction course, to improve the quality of teachers' teaching and students' practical ability, and to help students to be competent in construction management related work in the future.

1. Problems in Teaching Civil Engineering Construction Courses

The practice of students utilizing cell phones in college and university classrooms has been prevalent for quite some time. In the early days, cell phones mainly served the communication function and the entertainment function was relatively single, and the frequency of students using cell phones in the classroom was relatively low. As science and technology advance, smartphones have rapidly expanded their functionalities, including games, novels, short videos, and shopping, all accessible at a touch. While enhancing convenience and entertainment, this has posed a significant challenge to classroom instruction.

1.1 Construction Process

Construction technology refers to a variety of technical methods and operational steps used in the process of building construction. The current teaching mode presents multi-dimensional evolution characteristics: textbook level using text narrative combined with two-dimensional schematic static presentation, the introduction of BIM modeling, VR virtual simulation and other digital technologies to build three-dimensional visualization scenes, the teacher level to form a "traditional textbook + multimedia courseware + virtual reality technology" composite teaching path. Under this teaching framework, students are able to achieve instant mastery of construction technology in the classroom through model deconstruction, virtual operation and other figurative cognitive construction processes, and strengthen procedural memory through simulation practice. However, the cognitive load theory shows that there is a significant fading effect of this surface cognition, which is manifested in the lack of knowledge transfer ability, and it is difficult to cope with the variable management needs of the construction site. In essence, the teaching process favors the mechanical reproduction of operational representations and neglects the deep analysis of construction logic, resulting in students only obtaining discrete technical fragments and failing to build a transferable engineering thinking system.

1.2 Control Elements

The construction process control element system covers three dimensions of progress control, quality control and safety supervision. From the analysis of the course system structure, the progress management module is mainly integrated in the construction organization design course module, while the quality and safety control is throughout the construction technology professional course module. In the current teaching practice, teachers are in the main position of unidirectional knowledge transmission, relying on multimedia presentations and case studies and other teaching means to complete the knowledge transfer, and students are in a passive state of acceptance. It should be especially pointed out that, although this traditional didactic teaching can guarantee the efficiency of teaching information transfer, the lack of teacher-student interaction mechanism leads to insufficient participation in the classroom, which is manifested in the following way: learners are difficult to realize knowledge transfer through active construction, which ultimately leads to poor internalization of knowledge, and it is difficult to form a systematic cognitive structure.

1.3 Construction Organization

After the systematic study of building construction technology course, students have initially mastered the construction process and control points of sub-parts of the project. However, due to the fragmentation of the course content, the lack of systematic connection between the knowledge modules, resulting in students have not yet formed a complete engineering logical framework. Specifically manifested as: difficult to establish the time logic relationship between the sub-projects, unable to accurately judge the starting and ending nodes of the sub-projects, and thus do not have the ability to prepare construction progress plans.

2. Some Suggestions for Teaching Reform in Civil Engineering Construction Courses

2.1 For the Construction Process-Thinking Backwards

It is recommended to use reverse thinking teaching method in the teaching of construction process, and reverse the process from the engineering results. Taking the teaching module of reinforcing steel engineering as an example, it can be implemented according to the following steps: (1) Results display stage: present the results of the reinforcing steel skeleton before concrete pouring, including beam-column nodes, reinforcement spacing and other physical samples. (2) Problem-guiding stage: Through the question of “how to realize the structural form”, students are guided to think systematically about the pre-process of reinforcing steel engineering. (3) Process deconstruction stage: analyze the technical chain of processing (material calculation) - installation (positioning control) - acceptance (testing standards). (4) Knowledge construction stage: Combine with BIM model to dynamically demonstrate key construction links such as tying sequence and connection process. This method effectively cultivates students’ systematic engineering thinking through the teaching path of “result-oriented - process tracing”. It is recommended to use construction simulation animation and process decomposition atlas to help students establish three-dimensional process logic and deepen their understanding of the correlation between specification provisions and construction programs.

2.2 For Control Elements-Switching Roles

Realize the role transformation from “observer’s perspective” to “stakeholder’s perspective”. Based on the theory of situational cognition, we have constructed a “three-dimensional role immersion and four-dimensional process analysis” training system: in the main dimension, students are required to simulate the multiple role cognitive modes of the construction unit’s technical director, the construction unit's project director, and the supervisory unit’s professional engineers; in the process dimension, we have set up practical scenarios, such as the value engineering analysis of the construction preparation stage, the conflict coordination mechanism of the construction management and control, and the quality traceability system of the finished product protection period. In the process dimension, value engineering analysis in the construction preparation stage, conflict coordination mechanism in the process control, quality traceability system in the finished product protection period and other practical scenarios are set up; in the element dimension, multi-dimensional control indexes such as technical feasibility validation, economic rationality assessment and regulatory compliance review are integrated. Through role-playing driven dynamic decision-making, students are prompted to master the construction process control elements in depth. This "holographic engineering situation simulation" teaching method breaks through the limitations of traditional flat knowledge transfer, transforms abstract control elements into perceivable engineering decision-making constraints, and effectively cultivates the engineering system thinking of students to grasp the essence of craftsmanship in the balance of multiple objectives.

2.3 For Construction Organization-Control the Whole Situation

The course should focus on the system engineering attributes of engineering projects, and its teaching should break through the traditional fragmented cognitive mode and build a three-dimensional teaching system of "holistic view - interface management - dynamic coupling". Based on the theory of system dynamics, the implementation path of this course includes: firstly, constructing "double-base reinforcement" cognition - deconstructing the course module of building construction technology through the process logic network diagram, and using memory coding strategy (e.g., building construction limerick) to reinforce the memory of the process parameters of the sub-projects; and then carrying out the "virtual-reality mapping" engineering experiments. --Relying on the BIM collaborative platform to build a digital twin model, synchronize the implementation of the construction projection of the physical scale-down model, focusing on the analysis of the temporal and spatial coupling mechanism for the division of construction segments and the principle of dynamic balance of resource flow. In this process, students need to complete the "micro-process → meso-process → macro-system" of the third-order cognitive leap, through the simulation of the preparation of the construction schedule covering construction, construction layout, the main construction program and other elements of the "construction organization design" documents, and ultimately form the whole life cycle perspective of the engineering coordination capabilities. This dual-track teaching mode of "figurative-abstract" effectively solves the cognitive fault problem of "local cognition and global control" in traditional teaching, and enables students not only to master the logical arrangement of construction time sequence, but also to understand the non-linear interaction between process interfaces. The students can not only master the logical arrangement of construction time sequence, but also understand the non-linear interaction between process interfaces.

3. Conclusion

This paper focuses on the teaching reform of the Civil Engineering Construction course, and builds a theoretical framework of reverse thinking teaching, role-immersion simulation, and system dynamics to address the problems of theory divorced from practice, fragmentation of knowledge, and insufficient student participation in the current teaching. It should be noted that this study still has certain limitations: (1) the reform program has not yet been empirically tested in multiple rounds of teaching cycles, and its long-term effects need to be further tracked and evaluated; (2) the application of technological tools, such as BIM and VR, is dependent on the institution's hardware resources, and its promotion in resource-limited environments may face challenges. In summary, this study provides a systematic solution through innovative teaching methods and integration of digital technologies. It is expected that subsequent studies will further broaden the dimensions of engineering education reform and deliver technical and managerial talents with more practical and innovative capabilities for the high-quality development of the construction industry.

References

Li, J., Cai, K. K., & Wen, S. D. (2017). Reform and exploration of practical teaching of civil engineering construction course based on OBE concept. *Education Teaching Forum*, *2017*(52), 131-133.

Zhang, L., Zhang, W., & Gao, Banana. (2022). Research on the effectiveness of teaching reform of civil engineering construction course. *Sichuan Building Materials*, *48*(12), 234-235, 243.

Note(s)

Note 1. First in line is Ichisaku, and so on.