

Exploring the Teaching Reform of Higher Vocational Building Construction Process Course in the Background of Industrial Transformation and Upgrading in the New Construction Era

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Abstract: This paper takes the course "Building Construction Process" as an example, taking the transformation and upgrading of the construction industry in the era of "new construction" as the background, and aims to implement the teaching concept of "taking students as the main body", analyze and grasp the learning situation, develop teaching resources that integrate the post course and competition certificate, implement the requirements of course ideological education, carry out layered and classified teaching activities, and innovate the evaluation and assessment mechanism of the course. By implementing the teaching concept of "student-oriented", accurately analyzing and grasping the learning situation, developing teaching materials that integrate the post-graduation and competition certificate, implementing the requirements of ideological and political cultivation of the course, carrying out hierarchical and classified teaching activities, and innovating the evaluation and assessment mechanism of the course, the course aims to carry out the fundamental task of moral cultivation and human cultivation, and cultivate technically skilled talents with innovative thinking and professional ability, who can contribute to the transformation and upgrading of enterprises.

Keywords: construction process course; student-oriented; industrial transformation and upgrading; teaching reform

1. Introduction

Green construction, assembly construction, intelligent construction and construction industrialization are integrating with each other and developing synergistically, becoming a new engine for the high-quality development of the construction industry. The integration of industry and education is an irreplaceable choice to improve the professional teaching quality of students in vocational colleges and universities, and the course of building construction technology needs to be deeply integrated with the industry. Teachers can make students' initiative be fully mobilized by carrying out the teaching activities of course ideology and politics, and help to promote the professional teaching activities of the integration of industry and education to be put into practice.

2. Industrial background of curriculum reform

According to the "14th Five-Year Plan" construction industry development plan, as of 2020, the total output value of China's construction industry amounted to 26.39 trillion yuan, accounting for 7.1% of the proportion of gross domestic product (GDP), over the years, to promote the country's economic growth, alleviate the pressure of social employment, to protect and improve people's livelihood has made an important contribution to [1].

However, objectively speaking, the overall efficiency of China's construction industry is still not high, which is manifested in the rough way of development, low labor productivity, high energy consumption, high emissions, unregulated market order, generally low construction quality, and high incidence of project quality and safety accidents, etc. [1]. In order to adapt to the national industrial layout and the future development of the industry, China's construction industry should be deeply integrated with the advanced manufacturing industry and the new generation of information technology, vigorously accelerate the industrial transformation and upgrading, and realize the transformation from investment-driven to innovation-driven. While adhering to low-carbon development, construction enterprises should continue to extend the chain, build the chain and strengthen the chain in the fields of high-quality green buildings, smart factories, new materials, intelligent construction and intelligent operation and maintenance [2], so as to activate the vitality of the enterprise and seize the opportunities of future development.

The "new construction" era requires China's construction industry to develop in the direction of industrialized construction, actively promote digital construction in the urban and rural construction process, and realize on-site industrialized construction and industrialized factory production of construction products. Relevant enterprises should actively connect owners, developers, production (prefabrication) units, construction units, logistics and transportation departments, design units and supervision units through online platforms, so that factory prefabrication production and on-site construction can be docked in real time, and all relevant units through online platforms to strengthen the connection and realize the whole process of lean construction [2].

In short, the construction industry in the new construction era should promote industrialized production with industrialized construction, realize the greening, industrialization and intelligence of building construction through industrialized production, and finally realize the transformation and upgrading of the industry and improve the quality and efficiency.

3. The course content system reconstruction

The course of "Building Construction Technology" is a professional course for senior students of civil engineering. On the basis of accurately grasping the students' learning situation, the team designs and implements teaching activities from the teaching concept of "students as the main body" [3]. In order to meet the needs of industrial transformation and upgrading in the era of "new construction", to effectively cultivate and improve students' professional ability, and to implement the requirements of course teaching, the course teaching team (hereinafter referred to as the team) takes the initiative to dock with industrial enterprises, and endeavors to study the current high-tech and emerging skills applied at the forefront of engineering, and

to comprehensively understand the industry's new technologies, new technologies, new materials, and new equipment applications, as well as to understand the industry's new technologies, new technologies, and new materials. The teaching team of the course (hereinafter referred to as the team) takes the initiative to connect with the industry and enterprises, strives to learn the current high-tech and emerging skills applied in the frontline of engineering, comprehensively understands the application of new technologies, new techniques, new materials and new equipment in the industry, and integrates the above contents into the teaching of the "Construction Process" course. At the same time, We integrate the vocational skill standards for the positions of estimator and assembly building constructor, as well as the vocational skill competition standards for estimating skills, construction engineering literacy and application of building decoration technology, and the standards for 1+x certificate of Building Information Modeling (BIM), so as to reconstruct the curriculum content system that can significantly enhance the vocational ability of the positions of students and better meet the demands of the industry, and to form a modularized knowledge system and skill system.

In order to cultivate students' innovation ability, the team integrates industrial high-tech and emerging skills into the teaching of the course, introduces assembly building construction technology and new positions for assembly building constructors, exposes students to industrial changes by learning new technologies and understanding new positions, promotes students' cognition of new fields, stimulates new thinking, and also emphasizes the role of the course in supporting industrial changes and serving students' future development. Accordingly, the team has reconstructed the knowledge and skill system in the course teaching. Taking the module of building foundation and foundation construction as an example, the reconstruction of its curriculum system is shown in Figure 1.



Figure 1 Reconfiguration of the curriculum system for the Building Foundations and Foundations module

4. Learning Situation Analysis and Methodology

The team carefully researches the type of students' source, analyzes the learning situation from two contrasting perspectives: static and dynamic, commonality and individuality, so as to make a panoramic three-dimensional portrait of the students, gain insight into the students'

needs, compare the problems before and after teaching, and adjust the curriculum guide in time to achieve precise teaching. For example, the team through the quiz, the students' known and unknown knowledge areas, to find the students' next development area, to determine the starting point of teaching and teaching methods, to make up for the short board of students' knowledge and skills, which is a static analysis of the learning situation; Through the observation of students' learning status in the classroom, to analyze the reasons for students' poor learning status, and adjust the classroom teaching strategy, which is a dynamic analysis of the learning situation; the static and dynamic combination of the learning situation to accurately grasp, so as to The combination of static and dynamic can accurately grasp the learning situation, thus promoting accurate teaching. The team analyzes and adjusts the grouping of students so that students who study well are paired with those who are behind in their studies, and students with strong practical skills are paired with those who are weak in practical skills. Be sure to assign tasks within the same group so that the task is assigned to the person. By classifying the students, the tasks are stratified according to the level of difficulty to provide differentiated instruction. The process of learning situation analysis is shown in Figure 2.

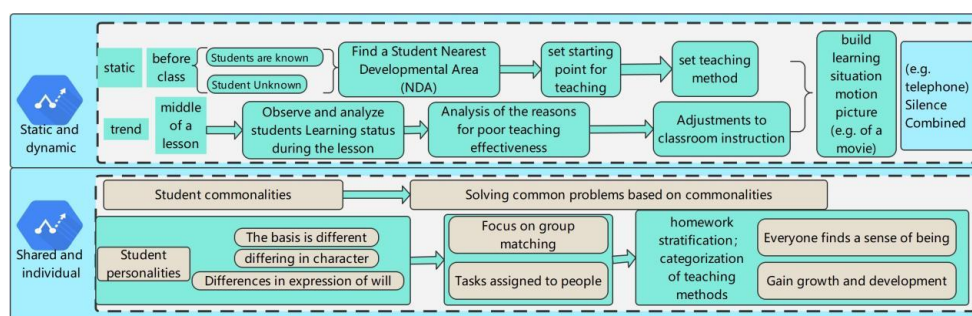


Figure 2 Flowchart of the two ways of learning analysis

5. Build diversified teaching resources

Combined with the emerging new methods, processes, materials and equipment in the industry, the team has built a teaching resource library for this course on the basis of careful study of the teaching objectives of the course and the professional training program, which has been used in practice for many years and achieved good teaching results, which can be summarized as follows:

(1)Emphasize the role of campus buildings. The team believes that the teaching of this course should be arranged as much as possible on campus, training sheds, typical completed projects or on-site construction sites, our school "building construction process" course set up a cognitive internship course in building construction, the class teacher with students under the campus building or building construction lecture building construction. Teachers take students under the campus buildings or inside the buildings to talk about building construction. They actively contact the construction sites inside and outside the campus, and let students visit and learn at the construction site. Through these situational teaching activities, the teaching quality of the course has been greatly improved.

(2) Enhance the application of knowledge and skills from previous or parallel courses in the Building Construction Technology program. For example, the application of knowledge and skills from courses such as "Engineering Geology and Geotechnics", "Construction Materials", "Engineering Drawing and CAD", "Engineering Surveying Technology", and other courses. Engineering Surveying Technology" and other courses. Cross-application of disciplinary knowledge helps students to build professional knowledge and skill system, cultivate students' engineering thinking and improve their professional ability. The team introduces the knowledge and skills of these courses into the teaching of "Construction Process" course, so that the knowledge system and skill system of each specialized course can be connected horizontally and vertically, effectively transforming the classroom of indoctrination into the classroom of dialogue, and the classroom of knowledge into the classroom of competence, and cultivating students' engineering thinking and innovation spirit.

(3) Introducing the technology of prefabricated building construction into the teaching of "Building Construction Process" course. The prefabricated building is the implementation of China's carbon peak by 2030 and carbon neutral by 2060 [4]. According to China's "14th Five-Year Plan" for the development of the construction industry, the proportion of prefabricated buildings in new buildings should reach more than 30% by 2025 [1]. The adjustment of the industry will inevitably bring changes in the demand for talents. Schools should carry out school-enterprise cooperation with enterprises that have prefabricated building construction projects, through contact with real projects, combined with the guidance of enterprise instructors, students will be able to have a better understanding of the new profession of prefabricated building constructor, and have a comprehensive and detailed mastery of prefabricated building construction technology.

(4) Some of the contents of the course have been "double developed" for teaching. The course has cut some of the complicated theoretical knowledge in the textbook and kept the important basic principles and methods. For the more difficult to understand knowledge, the team uses visualization "secondary development" to improve the teaching effect. The participation of company mentors also maximizes students' exposure to technical skills in the field. Close school-enterprise cooperation allows teachers to establish close contact with enterprise engineers. Teachers can link the professional qualification standards of enterprises, typical production cases, frontline engineering application technology, enterprise management and enterprise culture to the teaching of this course, so as to promote the improvement of students' professional ability.

6. Careful selection of course types

The team advocates the use of mathematical Wayne diagrams to classify course types. Through the module content characteristics to choose the appropriate type of course, through the type of course to choose the applicable teaching methods, in order to optimize the teaching organization of the course, innovation proposed "3 single 3 double" course type settings. The first "3" refers to the theoretical teaching, practical teaching, simulation teaching three types of courses; the second "3" refers to: theoretical teaching + practical training, theoretical teaching + simulation training, simulation teaching + practical training three types of control courses. That is, the same lesson, in order to improve the quality of teaching, the team against the

theory class + practical training, simulation of real training + theory class, practical training + simulation of real training class, to strengthen the cultivation of students' hands-on training, and strive to create a scenario-based teaching, so that the knowledge and skills into the brain into the heart, so that the quality of education is internalized into the heart of the externalization into the line. The setting of "3 single and 3 double" course type and its application in the module of building foundation and foundation construction are shown in Figure 3.

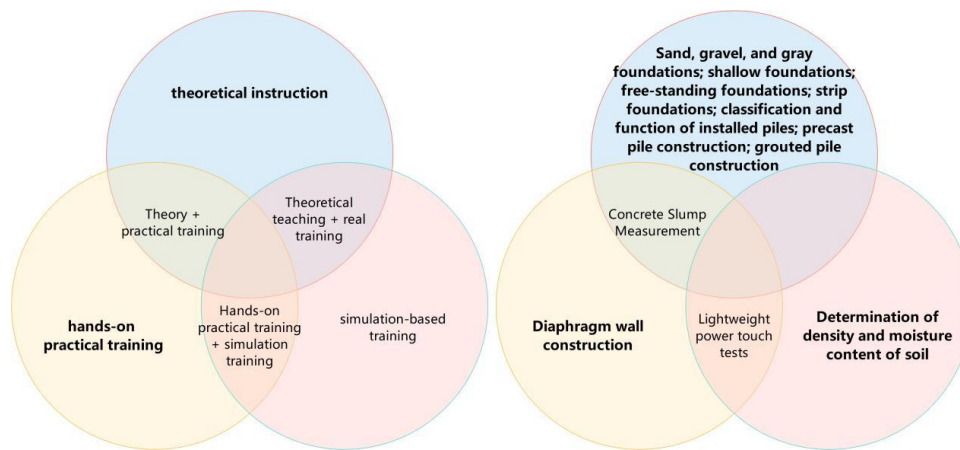


Figure 3 "3 single and 3 double" course type and its application in the module of building foundation and foundation construction

7. Reform and innovation of teaching methods

The team suggests different types of lessons and course content to choose the appropriate teaching methods. For example, today's construction safety is very different from traditional construction safety, which is manifested in safety education through software simulation. AR software or VR software is used to conduct safety technology briefing before the start of construction, so that frontline construction workers can be more proactive in accident prevention[5]. At the same time, intelligent security-related systems such as surveillance, facial recognition, electronic fencing, and fully-automated point cloud scanning robots are used on the construction site to make site safety prevention more intelligent, reliable, and efficient. In teaching, we should show these changes to students through VR and AR related software. Therefore, the teaching of this part of the content cannot be based on traditional teaching methods such as lectures and discussions, but should include the application of VR, AR software and smart wearable devices, and show them to students through hands-on demonstration and situational teaching methods [6]. In teaching practice, the team helps students to learn the experimental steps and operations by combining virtual and real practical teaching activities, thus realizing the all-round cultivation of students' knowledge, skills and professional competence, as well as highlighting the course focus and breaking through the difficult points.

8. In-depth development of the course ideology and politics

In the process of teaching implementation, the team actively optimize the course of ideology and politics, the implementation of training and training to promote the quality of students, in-depth excavation of the building construction process includes elements of ideology and politics (called mining), according to the content of teaching, selected safety awareness, standard operation of work attitudes, quality awareness, environmental awareness and humanistic concepts, etc. (called smelting) [7]. These elements of ideology and typical production cases, stories of outstanding people, etc., are quietly integrated into the teaching process, in a subtle process, to guide the cultivation of students' outlook on life and values (called alloying). That is, along the "mining → smelting → alloying" path of ideological and political education to carry out the first cultivation of students' quality, and then consolidate the basic knowledge of the curriculum, and on this basis to cultivate students' technical skills teaching activities, the formation of the course ideological and political education of the "pyramid model". The "mining → smelting → alloying path" and the "pyramid model" of course ideological and political education are shown in Figure 4.

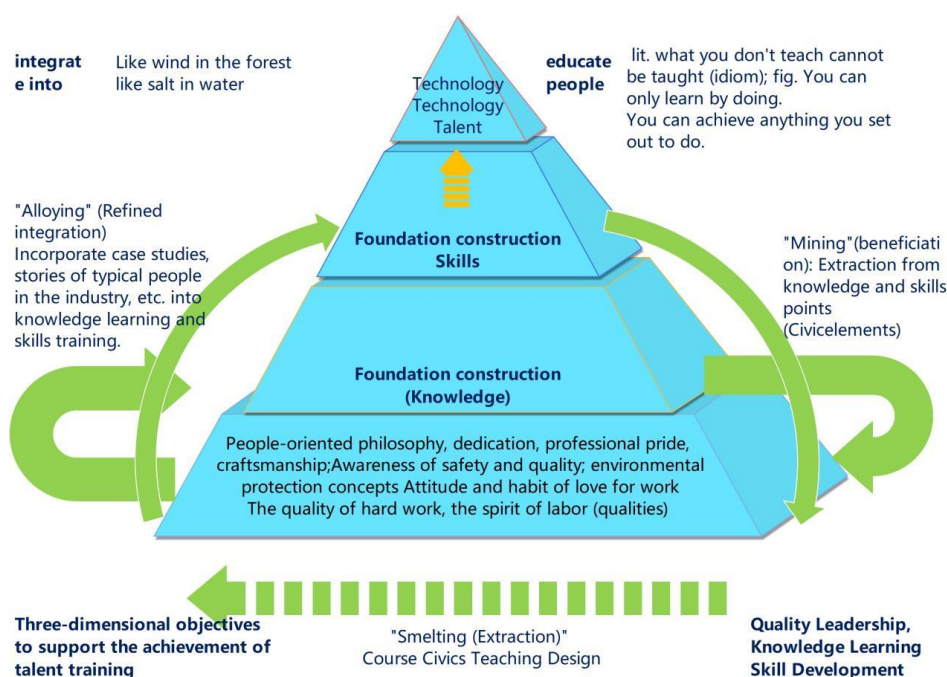


Figure 4 The "Mining→Smelting→Alloying Path" and the "Pyramid Model" of Civic and Political Education Curriculum

9. Reform and innovation of teaching evaluation

The team has established a two-dimensional and multi-subjective course evaluation and assessment mechanism in teaching practice. Traditionally, the evaluation of the "construction

technology" course focuses more on the examination of knowledge, but the team believes that the teaching of the course should cultivate students' professional ability, especially the learning ability, the ability to analyze and solve practical engineering problems, and the innovation ability. Teaching should not only "teach a man to fish", but also "teach a man to fish". Cultivating learning ability and innovation ability is especially important. Among them, the cultivation of innovation ability mainly starts from the following two aspects: on the one hand, when students study this course, whether they can connect and integrate the application with other professional basic courses or professional core courses. On the other hand, whether students can use the knowledge of this course to explain engineering phenomena, analyze and solve engineering problems. Meanwhile, the value-added evaluation of the course is emphasized. First, whether the students' academic performance is continuously improving. In teaching, the team gives students who continue to improve the corresponding value-added evaluation points, guiding students to change into a "better self" and promoting the formation of a good learning style. Second, students who have a sense of service and innovative thinking are also given extra points to guide the cultivation of students' sense of service and innovative spirit [8].

10. Conclusion

Under the background of the transformation and upgrading of the construction industry in the new construction era, the team in the "building construction technology" course in the implementation of "student-oriented" teaching concept, accurate research and assessment of the learning situation, in order to strengthen the students' hands-on practical ability as the fundamental innovation and development of teaching resources, rich teaching methods, reform assessment and evaluation, practice has proved that the teaching effect is good, the students' professional ability for the position and the ability to support the transformation and upgrading of the enterprise has been greatly improved [9].

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References

- [1]. "Fourteenth five-year plan" for the development of the construction industry[J]. Engineering cost management,2022(02):4-10.
- [2]. 3060Thinking about the Transformation and Upgrading of Construction Enterprises under the Background of Double Carbon Goal--An Interview with Gong Changyi, Chairman of Zhongyifeng Holding Group[J]. Intelligent Building,2021(08):6-9.
- [3]. JIANG You-Lu,LIU Hua,LIU Jing-Dong. Reform and construction of professional core curriculum under the background of engineering education accreditation[J]. China University Teaching,2022(12):37-40.
- [4]. SHUAI Yong,CHEN Shaowen. Reform Thinking and Practice of Energy Power Specialties in the Context of Carbon Neutrality-Taking Harbin Institute of Technology as an Example[J]. Research on Higher Engineering Education,2023(S1):7-9.
- [5]Habibi, A., Sofyan, S. & Mukminin, A. Factors affecting digital technology access in vocational education. Sci Rep 13, 5682 (2023)
- [6] Sacks, R., Girolami, M., & Brilakis, I. (2020). Building Information Modelling, Artificial Intelligence and Construction Tech. Developments in the Built Environment, 4, 100011.
- [7] Hong Yelong. Excavation and practice of civic and political elements in building construction technology course[J]. New curriculum,2023(03):1-3.
- [8] Ren Huimin,Chen Song. Research on value-added evaluation of students in vocational colleges and universities[J]. Vocational Education(Lower Lent),2022,21(01):11-17.
DOI:10.13565/j.cnki.issn2095-4530.2022.01.003.
- [9]. Chen Y,Qu T. Investment leads the transformation and upgrading of construction enterprises[J]. Highway,2018,63(07):275-277.