Research on the teaching reform of building structure course based on the intelligent construction background of new engineering

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Abstract: Architectural structure course is the core course of civil engineering major, which has the characteristics of strong practicality, great difficulty and a wide range of aspects. Under the background of intelligent construction of new engineering, the course needs to keep pace with The Times, reform and explore from the aspects of teaching content, teaching method, evaluation system and so on, so as to adapt to the talent training goal of civil engineering major under the new situation. This paper introduces the background and significance of the teaching reform of architectural structure curriculum, analyzes the problems existing in the teaching of traditional architectural structure curriculum, and puts forward the corresponding teaching reform measures to provide reference for the teaching reform of other courses of civil engineering major.

Keywords: new engineering; intelligent construction; civil engineering major; building structure; teaching reform

1. Introduction

With the rapid development of China's economy, China's construction has entered a period of rapid development. However, due to the existence of traditional design methods and construction technologies, frequent engineering accidents, difficult to guarantee construction quality, serious waste of resources and other problems, which also bring new challenges to China's construction. In this context, the CPC Central Committee and the State Council issued a series of policy documents, clearly put forward to improve the level of engineering quality and safety as the core, promote the made in China to China, China speed to China quality, Chinese products to China brand, from the high growth stage to high quality development stage of strategic goals. Under this background, the new engineering construction came into being. The construction of new engineering is centered on new industrial transformation and innovation, with the Internet, big data and artificial intelligence as the technological basis, to cultivate internationally competitive innovative talents and lead a new round of scientific and technological revolution and industrial transformation. And intelligent building is in the digital economy, industrial Internet, artificial intelligence and other new technology led by new building industrialization, it to meet the intelligent age of people's growing good life needs as a starting point, through the design and construction process of informatization, digital, intelligent and greening, make building products with functional, greening, customized, modular characteristics, form the traditional construction and digital economy integration development of new construction system, is the product of intelligent construction and building industrialization depth fusion.

2. Background and significance of teaching reform

Under the background of new engineering intelligent construction, with the rapid development of big data, Internet of Things, artificial intelligence and other technologies, the talent training of civil engineering majors is also facing new challenges. The structure course of architecture is a required course for students majoring in civil engineering. This course has the characteristics of strong theory, strong practice and a wide range of aspects. It not only requires students to master the basic theoretical knowledge, but also needs to have the engineering design ability and construction management ability. At present, there are many problems in the teaching of building structure course, such as: the

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theoretical teaching and engineering practice is not closely combined, the teaching method is single. Therefore, it is necessary to carry out the teaching reform of architectural structure curriculum to meet the demand for talents under the background of new engineering intelligent construction. The research and practice of the teaching reform of building structure course is beneficial to promoting the development of civil engineering major in universities. The traditional teaching of architectural structure focuses on the teaching of theoretical knowledge and lacks the cultivation of engineering practice ability and innovation ability. The curriculum reform of architectural structure should take students as the center, and cultivate students' engineering practice ability and innovation ability through the combination of theory teaching and engineering practice^[1].

3. The current situation of the teaching of the building structure course

"Building Structure" is one of the important basic courses of civil engineering. It mainly introduces all kinds of structures involved in architectural engineering, such as walls, columns, beams, boards and other basic components, as well as various types of structural systems, such as frame structure, shear wall structure, cylinder structure, etc. In the course of course teaching, students need to master certain structural analysis methods and be able to use the knowledge to design specific engineering projects. However, with the rapid development of the society, the traditional construction engineering design methods and construction technology have been unable to meet the increasingly complex and changeable needs of engineering projects, and cannot meet the needs of intelligent construction under the new situation. The traditional architectural structure course teaching is still teachers, students passively accept knowledge, it is difficult to stimulate students 'interest in learning; in the teaching process, teaching through the combination of theoretical teaching and practical teaching, in the lack of sufficient case support, students cannot understand the abstract concept; in the practical teaching, the lack of students' practical ability and innovation ability training. Through the questionnaire survey, it is found that the students are not very satisfied with the effect of the theoretical teaching, thinking that the theoretical teaching is boring, the knowledge point is abstract and difficult to understand, and the students' practical ability is poor. In order to adapt to the social demand and the talent demand change of the development of the new construction industry under the background of intelligent construction, the traditional building structure curriculum needs to be reformed accordingly. From the perspective of talent training, there is a certain gap between the traditional architectural structure course and the architectural engineering design method and construction technology under the background of intelligent construction. From the perspective of education, there are some problems of abstract course content and low students' interest in learning.

4. The effective path of teaching reform of building structure curriculum based on the background of new engineering intelligent construction

4.1 Establish a curriculum system of intelligent construction

Intelligent construction is an emerging technology that closely combines intelligent technology with engineering construction. It is applied to the field of construction through the Internet of Things, artificial intelligence, cloud computing, big data and other technologies, making it more intelligent and efficient. Through the establishment of a curriculum system with intelligent construction as the core, students can master the knowledge system of intelligent construction, and cultivate students' independent learning and innovation ability. In order to achieve this goal, the teaching reform needs to be carried out from the following aspects.

In the teaching of architectural structure course, engineering case analysis and design should be added, so that students can better understand the application of theoretical knowledge in practical engineering. For example, when explaining the reinforced concrete structure, let the students to understand the arrangement and function of steel in the reinforced concrete structure; the steel structure, let the students understand the arrangement and function of wood in the wood structure.

Under the background of new engineering, the talent training goal of civil engineering should be based on "new" and "deep". On the one hand, we should update the content of traditional teaching materials; on the other hand, we should increase the proportion of engineering practice cases in teaching, so that students can understand new knowledge, master new methods and be familiar with new norms through engineering cases. For example, the content of engineering case analysis and design can be added, and the content of engineering case analysis and design can be added to the steel

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structure^[2].

Traditional classroom teaching is difficult to stimulate students' interest in learning, so a variety of teaching methods should be adopted. For example, when explaining reinforced concrete structure, the basic theoretical knowledge can be explained through multimedia teaching video, PPT and the steel structure.

4.2 Building an intelligent construction teaching team

In order to adapt to the requirements of new engineering intelligent construction for the training of civil engineering professionals, it is particularly important to further improve the teaching quality of architectural structure course and build a teaching team of full-time teaching. Through the construction of the team, the reform and innovation in the teaching content, teaching methods and evaluation system, students will master the latest intelligent construction technology, can comprehensively use the knowledge learned to solve practical problems, and improve the comprehensive quality of students.

The team building needs to start from the following aspects. One is to add intelligent construction related courses to the teaching team. Combining with the professional practice, focus on civil engineering courses and the internal connection between intelligent construction technology, such as civil engineering courses of civil engineering materials and intelligent construction technology involved in the "basic theory of concrete structure" "basic design of reinforced concrete structure" "reinforced concrete structure seismic design", etc. Second, to cultivate students' innovative spirit and innovative ability as the core, combine scientific research results and teaching content, and actively carry out all kinds of scientific research projects and topics. For example, students participate in undergraduate tutorial system research projects, participate in graduate research projects, etc. Third, strengthen the construction of teachers, teachers through various ways to improve their comprehensive quality and scientific research level, take the initiative to participate in teaching reform and exploration. Such as the reform of the new curriculum system, intelligent construction related curriculum construction, school-enterprise cooperation development of curriculum materials and other work. Intelligent construction is an emerging industry formed by the combination of intelligent technology and construction industry. In the future society, intelligent construction technology will gradually be applied to the whole process of engineering construction. Therefore, this field needs a large number of talents with highly comprehensive ability and innovation ability. In the construction process of the team, it is necessary to deeply study the internal connection between intelligent construction technology and the training of civil engineering professionals, and on this basis, design a scientific, reasonable and targeted talent training program and curriculum system based on their own actual situation. In this process, we should combine theoretical teaching with practical teaching, and actively participate in scientific research projects and subject research. At the same time, pay attention to the cultivation and improvement of students' comprehensive quality such as innovation ability, teamwork ability and social responsibility. Only in this way can the intelligent construction technical talents with both professional knowledge and certain innovation ability and social responsibility be cultivated.

4.3 Improve the teaching content of the building structure course

The teaching content of the traditional architectural structure course focuses on theoretical teaching, but lacks engineering practice teaching. Under the background of new engineering intelligent construction, the curriculum reform should focus on cultivating students' practical ability and strengthen the teaching of practical links of architectural structure curriculum.

In the teaching of traditional architectural structure course theory, the content of practical links, such as architectural structure course design, reinforced concrete structure course design, masonry structure course design, etc., is added, so that students can complete the corresponding course design and experiment after class, and cultivate students' engineering practice ability.

Combined with the actual development of the current construction industry, pay attention to the analysis of engineering examples. For example, in the design of reinforced concrete members, the reinforcement technology of concrete structure is introduced to introduce new concrete materials to reinforce the structure, in the steel structure design of high-rise building, the difference between reinforced concrete material and steel material in the mechanical properties for steel structure material selection and structural design, and the performance of masonry materials and the basic structure of masonry structure.

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Subject competition is an important means to stimulate students 'interest in learning and cultivate students' innovative ability and team spirit. For example, in the design of reinforced concrete members, BIM assisted modeling and strength and stiffness calculation of reinforced concrete beams, slabs and columns; BIM assisted modeling and seismic performance analysis in masonry structure design; and BIM assisted modeling and seismic performance analysis of masonry structure in masonry engineering. By encouraging students to participate in various subject competitions, students 'interest and enthusiasm in learning are stimulated, and students' teamwork spirit and innovation ability are cultivated^[3].

4.4 Increase the proportion of practical teaching

New engineering intelligent construction background, building structure course teaching goal is to cultivate students 'innovation ability, practice ability and comprehensive ability, and the three ability is based on practice, therefore, the teacher in the classroom should focus on cultivating students' innovation ability and comprehensive ability, especially in the building structure course teaching, teachers should increase the proportion of practical teaching, enable students to apply theoretical knowledge to practice. First of all, teachers can encourage students to use holidays or spare time to actively participate in some architectural structure design competitions, innovation competitions and other activities, through these activities can not only stimulate students 'interest in learning, but also cultivate students' innovative consciousness and team spirit. Second, teachers can encourage students to participate in the building structure design project, teachers should be reasonable grouping project, let each group can have their own tasks and division of labor, this not only can improve the students 'learning efficiency and quality, can also to cultivate students' independent thinking, problem solving, unity and cooperation, etc. Finally, teachers should actively carry out school-enterprise cooperation activities. In the actual teaching, the students can go deep to the construction site for practical operation training, or to the related engineering projects for field visit and study, so as to improve the students' engineering practice ability. At the same time, teachers should also guide students to strengthen the learning and application of theoretical knowledge. In the teaching process, we should adhere to the principle of combining theoretical knowledge and practice, and only in this way can we improve the teaching effect and teaching quality^[4].

4.5 Enrich teaching methods and means

In order to fully mobilize students 'initiative in learning, stimulate their interest in learning, make them better master theoretical knowledge, improve students' ability to analyze and solve problems, a variety of teaching methods and means can be adopted, such as: heuristic, case type, discussion type, etc. For example, when explaining the structural system, we can introduce the concept of architectural structural system in combination with the requirements of architectural design, and introduce the idea of structural calculation in the explanation of structural calculation. You can also combine engineering examples to explain the knowledge learned. For example: a reinforced concrete frame-shear wall structure system adopts the double-layer two-way plate column-shear wall structure form, the lower layer is the frame, the upper layer is the shear wall, and there is a basement at the bottom. In this system, due to the existence of different load effect and different structural design requirements (such as: load effect, concrete strength, reinforcement strength, floor thickness, etc.). In order to enable students to better understand the stress performance of the system and the internal force and reinforcement of each component under different design requirements, it can be explained in combination with engineering examples. This requires teachers to carefully analyze the stress performance of each component and the reinforcement of each component under different design requirements. Under the traditional teaching mode, teachers need to convey teaching information to students by writing on the blackboard. In the background of new engineering intelligent construction, teachers need to display their teaching information through multimedia^[5-6]. For example, when explaining the structural system, the multimedia can show students the advantages, disadvantages, application and design requirements; the various components can be visually presented through the model diagram.

5. Conclusion

Intelligent construction is an inevitable trend of China's economic and social development, and also an inevitable choice to promote the transformation and upgrading of the construction industry and International Journal of New Developments in Education

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high-quality development. As a college teacher in the new era, Under the background of new engineering construction, We should actively change the teaching philosophy, To meet the society's demand for talents, Innovate teaching modes and means, Actively integrate into the new trend of the development of the intelligent construction industry, Combine theoretical knowledge with production practice closely, student centered, Integrating "teaching" with "learning", Improve students' innovation ability, engineering practice ability and teamwork ability; At the same time, we should combine theoretical knowledge with professional skills, Train students to master the new knowledge, new methods and new process of modern construction technology; We should also strengthen quality-oriented education for students, Improve students' comprehensive quality and innovation ability.

References

[1] Zhang Ziyuan, Gao Ning, Wang Hongyan, et al. Teaching reform and research of building Structure course under the background of intelligent construction of new Engineering [J]. China New Communications, 2022, 24 (23): 3.

[2] Zhang Xuesong, Chen Jinping. Exploration of the curriculum reform of architectural structure based on the construction of "new Engineering" [J]. Science and Technology Innovation Guide, 2018, 15 (10): 3.

[3] Gao Shangwu, Huang Mingjuan, Yang Haijun, et al. Research on the teaching reform of mechanics major in construction colleges under the background of "New Engineering" [J]. Western Quality Education, 2018, 4 (9): 2.

[4] Sun Qingwei, Gao Hui, Zhang Tong, et al. Research and Construction of curriculum System of Intelligent Construction Major under the background of new engineering [J]. Journal of Higher Education, 2023, 9 (2): 4.

[5] Wenwen S. Research and Reform on Teaching Content of "Building Structure and Construction"[J]. The Guide of Science & Education, 2016.

[6] Li Zhengdao, Guo Zhenchao. Exploration of teaching reform of digital management course of prefabricated building project under the background of intelligent construction [J]. Anhui Architecture, 2022, 29 (04): 98-100.