Research on the Teaching Method of the Integration of "Concrete Structure" Course and BIM Technology

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Abstract. With the wide application of building information modeling (BIM) technology in the field of construction engineering, the integration of BIM technology with the traditional "concrete structure" course has become an important teaching method to improve students' practical ability and theoretical knowledge. "Concrete Structure" course is the core course of civil engineering major. With the progress of science and technology, the teaching materials and teaching methods of concrete structure course are constantly changing, and the course is closely combined with practical engineering. However, civil engineering students in today's era have few opportunities to contact practical engineering. The introduction of BIM information technology into the concrete structure course can make students grasp the development trend of civil engineering in time, deepen their understanding of concrete structure, and realize the information and intelligence of concrete teaching. This paper discusses the concrete method of integrating BIM technology into the teaching of "concrete structure" course, analyzes the advantages and challenges of this teaching mode, and puts forward suggestions for improvement, in order to provide references for training high-quality engineering talents to meet the needs of modern construction industry.

Keywords: concrete structure; BIM informatization; Teaching methods; Curriculum integration

1 Introduction

In the construction industry, concrete structures are an important part of engineering practice. The traditional "concrete structure" course mainly focuses on the teaching of theoretical knowledge and the training of design methods. However, with the popularization of BIM technology in the engineering field, the traditional teaching method can no longer meet the needs of the industry for compound talents. By introducing BIM technology into the course of "concrete structure", it can effectively improve students' comprehensive application ability and cultivate their competitiveness in modern engineering practice.

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BIM technology is a technical means for the whole life cycle management of construction projects based on 3D digital models. It provides a more intuitive design, analysis and management platform by integrating various types of engineering information. BIM technology can not only improve the accuracy and efficiency of engineering design, but also play an important role in construction management and cost control. Therefore, combining BIM technology with a traditional curriculum can provide students with a more comprehensive and practical learning experience. This paper discusses the feasibility and implementation method of introducing BIM technology into the course of "concrete structure", analyzes the advantages and challenges of this teaching mode, and puts forward corresponding improvement suggestions, which provides theoretical basis and practical guidance for the reform of construction engineering education.

2 Traditional Teaching and Existing Problems of Concrete Structure

The course of "Concrete Structure" has been adhering to the principle of "emphasizing practice, strengthening ability, and emphasizing teaching characteristics based on experiment and practical training" as the main teaching content and teaching goal in the course teaching design. All colleges and universities are required to pay attention to training composite and applied talents, and strengthen students' understanding of concrete structure theory. The opportunity to improve the comprehensive ability and practical ability, plus a deep understanding of the concrete structure design content, can solve the problems existing in the actual development through the theoretical knowledge of concrete structure [1].

The traditional teaching content of the course "Concrete Structure" mainly teaches the concept, basic performance, mechanical characteristics of concrete materials and prestressed concrete structure, etc. "Basic Principles of Concrete Structure" lays the foundation for the subsequent course "Concrete Structure Design", all of which belong to the professional basic core courses. The teacher uses traditional theoretical teaching methods combined with videos or pictures, and some simple concrete experiments in the course, but these are not enough for students to fully understand the concrete structure, and they are not attractive enough to make students interested in this course, which is a comprehensive experiment and theory integration course, and most students think this course is difficult. The calculation amount is large, the calculation formula is complicated, and the learning process is a little unclear, and the teacher can not keep up with the rhythm of the class. In addition, most of today's classes are for the post-90s and post-00s, which are more active and have more ideas about courses, but most of them have fewer opportunities to contact actual engineering or concrete, and cannot see and touch the analysis of the force of concrete, and cannot have a good understanding of the calculation principle and force mechanism, which makes students tired of learning [2]. Therefore, speeding up and enlarging the teaching reform of concrete structure course has become an important content in the theoretical teaching of concrete structure course. Zhang Jisong put forward a method of expression and reasoning of rules of

structural design code by translating the design terms of Concrete Structure Design Code. This method can convert semi-structured design specification terms into structured knowledge and support flexible query and reasoning [3].

The traditional "concrete structure" course is mainly carried out through classroom teaching, written work and hand calculation design, and there are the following problems:

(1) Disconnection between theory and practice: Traditional teaching attaches great importance to the transfer of theoretical knowledge, but students lack experience in the design and operation of practical engineering projects.

(2) Single teaching method: mainly taught by teachers, and students' active learning and innovation ability are difficult to give full play to.

(3) Disconnection from the development of industry technology: With the development of emerging technologies such as BIM, traditional teaching methods are difficult to meet the industry's demand for new skills.

3 Application of BIM Information Technology in Teaching

BIM technology not only has a strong application range and application value in the engineering field, but also has been widely promoted in the construction industry, which greatly promotes the education and teaching of architecture majors in colleges and universities, and also has a very important application space and application value in the process of personnel training in relevant colleges and universities. In particular, it has a positive effect on cultivating high technology applied talents.

3.1 Introduction of BIM in Course Design

In the teaching plan of the course "Concrete Structure", the relevant content of BIM technology is added, covering the basic knowledge of BIM, the operation of BIM software and the application in the design of concrete structure. At the same time, BIM technology is combined with course design, so that students can use BIM tools in practical design tasks and cultivate their information-based design ability.

The course of "Concrete structure" is usually divided into two parts: "principle" and "design". The difficulty lies in the calculation of beam, plate and column components in the design course. If BIM technology is effectively combined, the failure process and failure state of the components under stress are presented in a unified manner, and the collaborative teaching mode in an immersive environment is realized, which will be of great help to students' understanding of the calculation of components [4]. When BIM technology is integrated into teaching, the teaching content will inevitably increase. Under the condition that the original class hours remain the same or are reduced, the knowledge points and knowledge system of "Concrete structure" course will be sorted out as far as possible, and the teaching content will be reconstructed to change from the original emphasis on learning knowledge to the emphasis on problem-solving methods and problem-solving thinking, and only one content of the same type will be taught. At

the same time, the theoretical teaching content, such as "Basic principles of concrete structure", is taught in the form of MOOCs, difficulties and doubts are marked, and the class takes up less hours to sort out and explain. The classroom teaching focuses on "concrete structure design", cultivating people with professional significance and introducing lower-level talents.

3.2 BIM Application in Practical Teaching

In the practice teaching, students are organized to model, analyze and optimize the design of concrete structures through BIM software. Through practical project cases, students can fully grasp the whole process from structural design to construction management, and exercise their teamwork and project management skills in the process. For example, the application of BIM technology in the construction of laminated steel plate reinforced concrete sandwich floor, the use of this technology not only improves the construction efficiency, but also reduces the waste of labor and materials, and later maintenance investment, greatly saving the construction cost and significant economic benefits; The application of this technology not only enriches related technologies, trains management talents and construction teams, but also accumulates experience in subsequent similar projects, and has outstanding social benefits[5].

3.3 BIM Teaching with Multidisciplinary Integration

The application of BIM technology is not limited to structural design, but throughout the entire life cycle of the project. Combining the course of "Concrete structure" with other related courses such as building materials and construction technology, and carrying out interdisciplinary teaching on the platform of BIM can cultivate students' ability of system thinking and comprehensive design.

4 BIM Information Technology Personnel Training

In fact, talent training is not only colleges and universities, but also enterprises. The talent training of colleges and universities is based on the needs of enterprises, and the needs of enterprises are in line with the development of The Times. For colleges and universities, different schools should have different positioning for themselves, and what kind of talents should be transported for what kind of enterprises. The second is the change of concept, the concept of the system, including the change of the concept of teachers, to embrace the new technology, in the current era, the construction industry is to fully integrate BIM technology. With these two points, the third is to establish a system and platform, the platform in turn to design and construction enterprises to have close communication, to have practice, practice can in turn promote talent training.

The talents trained by colleges and universities are high-level talents such as structural engineers and project managers, and the knowledge of designers and structural engineers needs to be updated in real time to keep pace with The Times. First of all, in terms of teaching thinking mode, it is necessary to transform, improve and have novel

thinking, and teaching tools should have engineering thinking and system thinking [6]. It turns out that the traditional concrete design teaching plan is the main link in the entire civil engineering course teaching, which is relatively synchronized or pre-opened courses. In the teaching process, the whole course can be used to participate in the BIM teaching link, integrating the cross-learning and application of multiple courses, which is a large field and has great challenges at the same time. According to the standard design, now the teaching should be changed to the setting of conditions and teaching, systematic integrated design, which is very demanding for teachers, the so-called systematic is to consider the development of the entire industry, the integration of multi-course teaching methods and use. As a university, it is necessary to help students improve their cognition of concrete structures. BIM theory can help students to better design structures from the mode of failure of concrete structure components, including the structural inspection and reinforcement work to be done in the future, and help architects improve their design ability through big data platform. As a student, the most important thing is knowledge arrangement. In this context, knowledge re-planning helps students improve knowledge composition. For example, In order to give full play to the advantages of 3D collaborative design of BIM technology and improve the design effect of industrial buildings, the BIM technology design process is combined with the actual project, and BIM technology is designed from the aspects of building BIM model, portal rigid frame steel structure BIM model, internal platform concrete frame BIM model, pool BIM model, industrial building overall BIM model and so on Finally, the collision inspection of industrial building design is implemented to ensure the design quality[7].

On the other hand, there is the demand for courses in the new era, including the demand of new industrialization, the intelligent installation on site, and the service of the delivered products in the whole life cycle, which is a great challenge [8]. The teaching work in colleges and universities is a transformative work, which enforces traditional teaching with information means. A lot of preparation and preparation work is required [9]. Teachers need to understand information technology, follow up the basic work, lay a standard foundation, reshape the process, and cooperate with the follow-up links. The upstream is the pre-course, and the downstream is the operation and maintenance of the synchronous course and even the subsequent course teaching mode. Only by using BIM technology to cooperate in the teaching can it have its value. Taking prefabricated concrete structure as the research object, the new process and BIM technology of structure are analyzed. By analyzing the new technology applied to prefabricated beam, prefabricated board and prefabricated column, and discussing the concrete action mode and effect of the new technology based on engineering practice, the paper hopes to lay a foundation for the development of prefabricated building. At the same time, attention is paid to the visual characteristics of BIM technology, and the application mode and specific role of introducing this technology into the construction of prefabricated concrete structures based on the new process are analyzed, so as to support the improvement of efficiency and quality[10].

5 Advantages of Curriculum Integration

Through the combination of BIM technology and courses, students not only master the professional knowledge of structural design, but also cultivate its comprehensive application ability in practical engineering projects, such as modeling, analysis, optimization design, etc., to improve students' comprehensive ability; The introduction of BIM technology makes the teaching method more intuitive and interactive. Through virtual simulation and project practice, students can have a deeper understanding of the design principles and construction methods of concrete structures. Enhance the interaction and practice of teaching; With the increasing demand for BIM technology in the construction industry, graduates who have mastered BIM technology have a greater competitive advantage in the job market. Adapt to the needs of industry development.

6 Challenges and Suggestions for Improvement

6.1 Improvement of Teachers and Teaching Resources

The teaching of BIM technology requires teachers to have certain experience in software operation and engineering application. Therefore, schools should strengthen the training of teachers to improve their application ability of BIM technology; The smooth development of BIM teaching requires certain hardware and software support, such as computer equipment and BIM software authorization. Schools should increase investment in these aspects to ensure the availability of teaching resources [11].

6.2 Innovation of Teaching Model

In the process of the integration of BIM technology and curriculum, the teaching mode needs to be constantly innovated to stimulate students' learning interest and initiative [12]. Schools can try to adopt new teaching models such as project-driven teaching and flipped classroom to improve students' participation and learning results. South China University of Technology has carried out a series of reforms on the graduation design objectives, topics, design content and results submission of civil engineering major, introduced prefabricated concrete structure design, and deepened the design of prefabricated components based on BIM, changing the traditional status of cast-in-place concrete frame structure design as a single design content. Therefore, students' software application skills have been greatly improved, and students have a deeper understanding of the detailed structure, production and construction process of prefabricated components [13].

7 Future Development Direction

In the future, BIM technology will play a greater role in the field of construction engineering, and schools should continue to explore its application in teaching to train more high-quality talents to meet the needs of modern construction industry. In addition,

through school-enterprise cooperation, students can increase the practical opportunities of practical engineering projects, so that they can better combine theory with practice.

8 Conclusion

BIM information technology is the future development direction of civil engineering, and the application of BIM information technology in teaching is in line with the development trend of the current era. The application of BIM technology in the teaching of "Concrete Structure" is an update of the concept of keeping pace with The Times, and the cultivated talents should adapt to the future development. Colleges and universities also need to consider the comprehensiveness of teachers' majors in the construction of teacher teams, and the research direction of teachers should be forward-looking research and integration of science and education. At the same time, the course system is sorted out, related courses are merged, credit Settings are increased, BIM technology is used to integrate teaching, and information talents are cultivated. Finally, the curriculum setting and teaching methods of civil engineering-related courses should be more in line with international standards in contemporary times, so that students' thinking mode and level of problem-solving can be changed, instead of teachers explaining methods, they can actively learn and solve problems by themselves, and strive to keep up with the pace of development in today's civil engineering era.

The integration of BIM technology with the course "Concrete Structure" can effectively improve the teaching effect, enhance the practical ability of students, and adapt to the development needs of the construction industry. Although there are some challenges in the actual teaching process, through teacher training, resource improvement and teaching innovation and other measures, the teaching mode of BIM technology and curriculum integration will become an important way to train construction engineering talents.

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