

Research on Teaching Reform of Civil Engineering Majors in Higher Vocational Colleges based on BIM Technology

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Abstract: With the promotion and application of BIM by the Chinese government, the project of BIM technology has been increasing, and the construction industry has entered the BIM era, and the demand for BIM application talents has become increasingly prominent. However, the BIM teaching of civil engineering majors in China's higher vocational colleges is still in the exploratory stage, and there are many problems in BIM teaching. This paper systematically expounds the current status of BIM teaching at home and abroad, as well as the common misunderstandings and major problems in the process of BIM teaching in civil engineering majors in China's higher vocational colleges, and proposes methods and suggestions for BIM teaching reform. The civil engineering majors in higher vocational colleges provide reference for BIM teaching reform.

1. Introduction

In recent years, BIM technology has become more and more widely used in the construction industry. It is a perfect combination of digital information and computer technology, which shows the design of engineering projects in a three-dimensional way, and guides the construction, maintenance and operation of the project [1]. It integrates construction project management and technology, and has the characteristics of simulation, visualization, map release, optimization and coordination. With its wide application, training professional BIM technical talents has gradually become the main task of colleges and universities [2]. The engineering major of colleges and universities is the main position for cultivating construction talents in China. It should actively introduce BIM technology into the process of teaching, accelerate the reform of teaching content and teaching methods, grasp the market orientation and needs, and cultivate more for the Chinese construction industry. Professional talents with excellent professional have quality and comprehensive ability.

2. BIM concept and its extension

BIM (Building Information Modeling) is an abbreviation of Building Information Model. It is an application of information model in the construction engineering industry. BIM technology is a method and tool for creating and using the information model to manage and optimize the whole process of design, construction and operation of a construction project [1]. The model is shown in Fig.1.

With the continuous development of BIM applications in various countries, the Chinese government has been increasing the number of BIM projects for the promotion and construction of BIM. The construction industry has entered the BIM era, and the demand for talents for BIM applications has become increasingly prominent. At this time, colleges and universities should clearly understand the current development of BIM applications and strengthen the cultivation of talents for BIM applications [2].

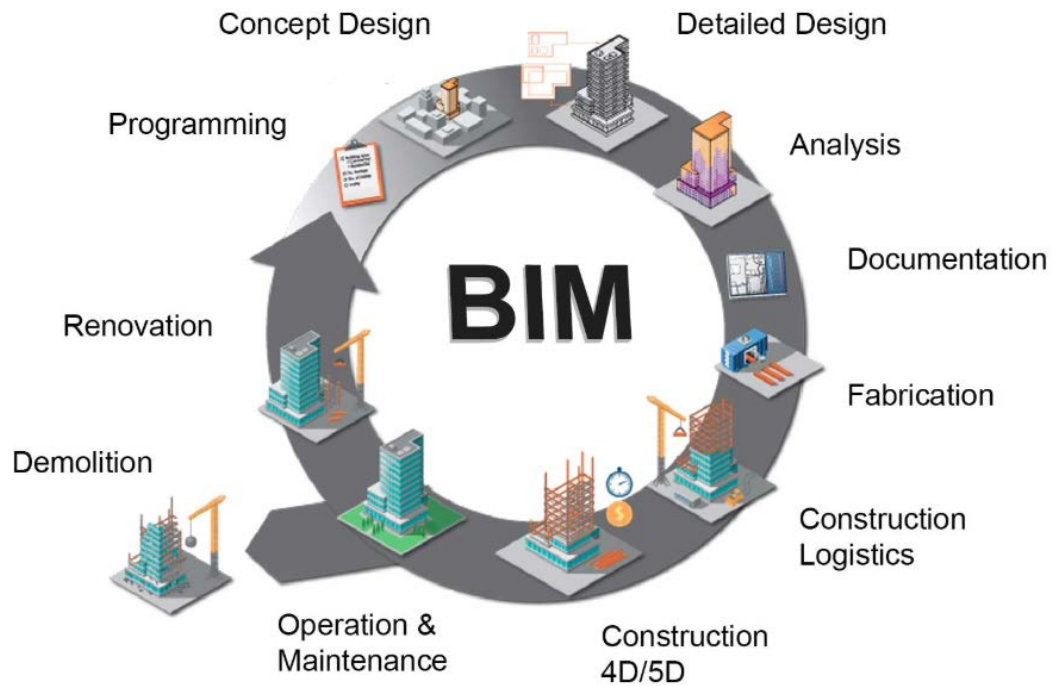


Fig. 1 BIM process technology model

3. Disadvantages of the traditional civil engineering teaching mode

At present, the teaching of civil engineering in higher vocational colleges mainly follows the traditional teaching mode. The traditional CAD two-dimensional design method is difficult to express the three-dimensional real effect [3]. When it is necessary to go deep into the details, it is difficult for students to form the internal structure of the building.

In order to strengthen the cultivation of students' professional ability, most vocational colleges in China currently use the combination of classroom teaching and construction site practice teaching in civil engineering courses [2]. However, due to various factors, students can only form a split and fragmented perceptual understanding of the construction process. When it comes to Abstract and complex teaching content such as structural structure, it is difficult to form an overall understanding. Students are still passively accepted.

With the rapid development of information technology, some civil engineering professional teachers have made active attempts to assist teaching with pictures and animations, audio, video, PPT, projectors and other software and hardware. This has played a role in helping students and teaching assistants to a certain extent, and has also improved the intuitiveness of teaching [1]. However, it still does not break through the limitations of traditional teaching models. The traditional civil engineering curriculum teaching model is facing enormous challenges.

4. BIM technology teaching overview

The characteristics of BIM technology teaching. The teaching of BIM technology is different from the traditional teaching mode of architectural engineering. It requires students from all disciplines of architecture and engineering to cooperate and cooperate with each other. First of all, students majoring in engineering and engineering should have solid professional basic knowledge, fully master the BIM modeling software of this major, and have a preliminary understanding of other professions [3]. In the process of applying BIM technology teaching, teachers need to create a collaborative learning atmosphere for students, encourage students to cooperate with each other, and encourage students to conduct independent learning, cooperative learning, and inquiry learning. Through the collaboration between students of various majors, it promotes the mutual integration and mutual penetration of various professional knowledge, develops the comprehensive ability of students, improves the curriculum content among the majors of architectural engineering disciplines,

optimizes professional settings, and cultivates students' professional knowledge. Ability to use, communication and organizational coordination.

The significance of BIM technology teaching. BIM technology involves all the processes of design, construction and management of construction engineering. It has a wide range and has certain leading position in these aspects. It has gradually become the development direction of the future construction industry. In the world today, BIM technology has been regarded as a necessary skill for construction engineering professionals, and universities are constantly applying BIM technology to the teaching of engineering majors. The use of BIM technology teaching mode in the teaching process of college engineering majors can not only meet the needs of the society for BIM technology professionals, improve the employment status of college graduates, but also cultivate students' ability of independent learning and collaboration. Through BIM technology, the simulation design and construction of engineering projects can improve students' ability to translate theoretical knowledge into practical skills, and solve the professional problems through collaboration with other professional students, so that students can learn from each other and analyze problems [4].

The ability to communicate and collaborate has improved. BIM technology meets the requirements of complex construction and fine management of modern construction engineering. Applying BIM technology in college engineering professional teaching can enable college students to acquire more professional technical knowledge, comprehensive ability in many aspects, and stronger professional competition. Force, create more employment opportunities for themselves, and indicate the direction of career development [3].

5. Virtual construction technology of BIM as carrier

Providing conditions for innovation in the talent training model. Guided by the demand for information construction in the construction industry, a curriculum system featuring BIM is formed. Exploring 3D design technology based on BIM technology, improving parameterization, visualization and performance design capabilities, and providing technical support for design and construction integration, can reduce the loss of information in the process of transmission. On the basis of extensive research, we timely adjusted the 2012 version of the civil engineering professional training program, and added the "BIM Technology Application" professional course in the curriculum system [4]. On May 10, 2012, during the demonstration of the 2012 edition of the Civil Engineering Professional Training Program, the professional construction committee participating enterprises experts fully affirmed and highly praised the addition of the BIM Technology Application course in the curriculum system.

BIM-based virtual construction technology. CDIO engineering teaching model innovation the civil engineering major in our school has been reforming the CDIO engineering teaching model since 2010. It has developed 12 CDIO standards. Through the 3D digital construction technology based on BIM technology, the door steel frame factory building and reinforced concrete structure are designed. Building projects and other projects, through virtual construction, innovated the application of CDIO engineering teaching mode in civil engineering majors, as shown in Fig. 2. The following is an example of a portal steel frame plant project [5].

1) Scheme concept (C). Based on the building standards, taking into account the typicality of the project and the size of the model, the students are guided by the overall concept.

2) Project design (D). According to the steel structure design specification, the wedge joints of the column foot joint, the steel frame column and the steel frame beam, the connection node of the steel frame beam and the steel frame beam, and the stiffener setting are completed.

3) Virtual Construction (I). According to the design blueprint, the virtual construction of the portal steel frame plant is completed by the BIM application software, as shown in Fig 1.

4) Collision check (O). After the completion of the overall construction, a collision check was carried out, and problems such as errors, leaks, bumps, and defects in the design were found. After the collision check, the lower flange of the steel column and the stiffener rib collided, and the plate of the stiffener has penetrated into the lower flange. Complete this teaching project after all collisions have been processed.

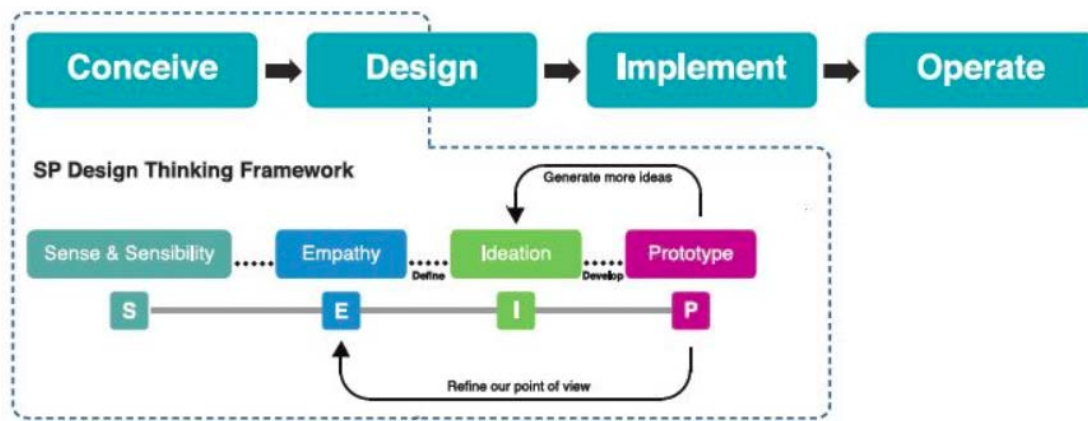


Fig.2 CDIO engineering model

6. Strategy of teaching reform of civil engineering major based on BIM technology

6.1 Maximize the application of BIM technology teaching.

In the process of applying BIM technology for teaching, college engineering majors should change the teaching mode, pay attention to the professionalism, flexibility and timeliness of BIM technology, actively cooperate with off-campus construction units and software development companies, and strengthen the curriculum. The arrangement of practical teaching strengthens the effect of practical teaching. At the same time, BIM modeling courses should be opened separately on the basis of the original professional courses (such as CAD) to teach BIM technology for engineering students. China's current BIM software can import data from MagiCAD, Revit, and Tianzheng, Haochen and other software to build a three-dimensional model, and also use the software's own functions to build a three-dimensional model [5]. The compatibility of BIM software with other drawing software can greatly shorten the modeling time between different professions and different software, so that BIM technology can be maximized in teaching engineering, improve teaching quality and efficiency, and give full play to the advantages of BIM technology.

6.2 Strengthen the construction of BIM technology teaching team.

Colleges and universities should strengthen the construction of engineering professional teachers, actively introduce professional talents of BIM technology, strengthen the training of teachers in the school, actively organize the teachers' learning of BIM technology, improve the evaluation system of teachers' BIM technology teaching ability, and build one. The BIM technical teaching team with excellent knowledge, strong ability and rich experience guarantees the quality of teaching. In addition, colleges and universities should strengthen the training of BIM teaching talents' practical experience. Through cooperation with off-campus engineering enterprises and software development enterprises, college engineering professional teachers can enter the actual project to train, enrich teachers' participation in engineering construction and practical application of BIM technology. The experience enhances the teacher's practical ability, so that he can teach BIM technology through practical engineering in the teaching process, become a professional BIM technical teaching talent, and make due for the BIM technology teaching work of engineering majors in colleges and universities. Contribute to train more BIM professional and technical talents for the society [6].

6.3 Establish an effective teaching management mechanism.

All colleges and universities in China should speed up the establishment of effective BIM technology teaching management mechanism and standardize BIM technology teaching behavior. According to the characteristics of various majors and curriculum settings in the construction engineering, the information model data is effectively integrated to ensure the output information has practical value. Establish a special BIM technology leading group to be responsible for the teaching of BIM technology in schools, and regularly conduct random checks on the quality and efficiency of

BIM technical teaching of all professional teachers, and eliminate the unqualified teachers [4]. In the process of teaching BIM technology, give full play to the advantages of each major, strengthen communication and communication between teachers, increase research on teaching methods and teaching techniques, and continuously promote the improvement of management system.

6.4 Accelerate the reform of BIM courses in engineering majors.

Colleges and universities should speed up the reform of BIM technology in engineering majors, combine BIM technology with practical teaching, and rationally set up BIM technology teaching courses. In the first year of the new year, students should begin to popularize BIM modeling software knowledge, so that students can create complete structural construction process animation through BIM technology to attract students' interest. Actively use the school's teaching resources, use internet technology, establish a construction simulation laboratory for students, encourage students to integrate the internship engineering drawings through BIM software, and make a virtual four-dimensional construction simulation map to deepen students' construction design and construction [6]. Understand the management process, be familiar with the construction characteristics of construction projects, and increase your own experience in BIM technology application.

7. Summary

BIM technology is the future development direction of the construction engineering field, and it has a relatively advanced leading role in the process of construction engineering design, construction, supervision and operation. Under the background of the current promotion of BIM by Chinese government departments, it is necessary to introduce BIM teaching into the civil engineering professional teaching mode of higher vocational colleges, not only to meet the development needs of the construction market, improve the employment situation, but also promote students' independent learning. The comprehensive development of competence, collaboration and professional knowledge has made positive contributions to the development of China's BIM technology and the cultivation of high-quality skilled professionals.

References

- [1] L.M. Huang and W. Li, Research on the promotion of BIM technology in the teaching of architectural engineering, *Time Teaching*, 2015, vol.11, pp.155-156.
- [2] W.H. Zeng and W.M. Fu, Application Research of BIM Technology in College Teaching, *Journal of Heilongjiang Ecological Engineering Vocational College*, 2014, vol.6, pp.85-86.
- [3] G.D. Wu and Ch.L. Tang, Reflections on the Integration of BIM Technology into College Engineering Management Teaching, *Higher Architecture Teaching*, 2015, vol.4, pp.156-159.
- [4] J.H. Chen and H.L. Guo, Reflections on setting up BIM courses in the professional course system of higher vocational construction cost, *Journal of Taiyuan Urban Vocational and Technical College*, 2017, vol.2, pp.103-104.
- [5] J.H. Cui, Sh.S. Xia, K.W. Ding and D. Chen, Exploration of BIM technology applied in practical teaching of civil engineering specialty, *Anhui Architecture*, 2015, vol.3, pp.45-46.
- [6] H.D. Li, Applied Research on BIM Technology Integration into Engineering Majors in Colleges and Universities, *Civil Engineering Information Technology*, 2015, vol.4, pp.108-111.