Optimizing the Practice Teaching of Civil Engineering with BIM Technology

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ABSTRACT

Building Information Modeling (BIM) is a building model based on the related information data of the construction project. It can display, analyze and optimize the plan in the process of building design construction and operation maintenance. In the age of informatization, the application of BIM technology in civil engineering teaching is one of the most important measures to drive the reform of civil engineering practice teaching. It is helpful to enhance students' professional quality and cultivate students' innovative ability. According to the application in teaching practice, the paper highlights the superiority of BIM comparing to traditional teaching method.¹

INTRODUCTION

In the new era, Architectural CAD technology has been going through profound and significant changes from simple 2D or 3D drawing to comprehensive building information model (BIM) technology [1]. The model is a large information design and teaching platform, which integrates various architectural information data including modeling, design, cost, etc.

In May 2011, the Chinese Ministry of Housing and Urban-Rural Development issued the outline about informatization development of construction industry in 2011-2015 years”. Explicitly pointed out that during the period of “twelfth five-year

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plan”, carry out the research and application of BIM technology; facilitate the BIM technology extends from the design phase to construction phase; and reduce the attenuation in the process of information transfer. On May 4, 2012, Chinese BIM development league and the editing group that compiled the national standard “unified standard of building information model application” issued “BIM standard research project application guide in China”, which got the positive response from industry insiders. Then the BIM standard research project in China got started. In July 2015, the Chinese Ministry of Housing and Urban-Rural Development enacted “the instruction about promoting the application of building information model”. It emphasizes the significance of BIM application in the field of construction and puts forward the guiding ideology and basic principles of building information model application to promote the application of BIM. Namely, “by the end of 2020, level-A survey and design institute, special-class and first-class engineering construction of house building enterprise should master and implement the integrated application between BIM and other information technology like enterprise management system; by the end of 2020, the proportion of new projects including large and medium-sized buildings with state-owned capital investment, and declaring green public buildings and green ecological demonstration community will reach 90%”.

Therefore, it is a tendency for us to use BIM technology in the construction industry. Especially, it is necessary for colleges and universities to cultivate talents with knowledge of BIM technology.

RESEARCH OVERVIEW

It is very timely and necessary to promote BIM technology in our country, but the development of BIM in our country is still in the initial stage. The technology and theory are not mature enough. Construction industry adopting the BIM technology is expected to enhance performance and profit ability. However, the company is now emerging BIM talent shortage. The ministry of education claim that university should deepen the reform of talent training mode. Improve the institutional mechanism for improving the quality of teaching. Implement the teaching quality and teaching reform project. Moreover, strongly support the employment-oriented reform and construction. Colleges and universities cultivate talents in the area of BIM is in accordance with the spirit advocated by the ministry of education. At the same time, implement the concept and practice in the BIM teaching. And cultivate the application technical talents who meet the requirement of construction informatization and social demand. It will put forward effective solutions to the shortage of BIM talents and the difficulties of college students' employment.

Foreign countries started the application of BIM earlier [2]. In 2011, Texas Business School proposed to apply BIM programs into the study of personalized students. The University of Oklahoma is working on a design and operational framework for BIM courses. Auburn University offers BIM software courses for
construction professionals. The University of California has introduced BIM technology in the cost estimation curriculum to improve the speed and efficiency that students complete their assignments. The construction management major of Colorado state university replaces the computer aided design course with the BIM curriculum, and trains the basic modeling ability of students to integrate the BIM teaching unit into the professional knowledge.

Sequentially, with the rapid development of BIM technology, its unique advantages has aroused great attention of scholars at home. Universities in China start to bring in BIM technology based on their own teaching requirement. First, some universities add some software courses related to BIM. Then most engineering universities have offered 3D software courses, such as Revit software. Some universities, such as Tsinghua University, Tongji University and Tianjin University, have offered BIM software courses in undergraduate fields. Other universities offer BIM courses in the form of elective courses, such as Shandong University of architecture, Xi’an University of architecture and technology, Shenyang University of architecture and so on [3]. Second, some universities have established BIM research groups and research centers successively. For example, Tsinghua and GLodon work together to establish a construction information model research center. Tianjin University launches Autodesk ATC BIM training station. Third, universities actively participate in the national college BIM software building information model competition. China Association of Construction Education sponsored the competition in 2010 and Thsware holds it once a year. It has been successfully held six sessions. At present, our school has offered a BIM course in graduate education, and two graduates have applied BIM technology to graduation design. Last year, our school took part in the sixth Thsware BIM competition for the first time, obtaining the team first prize and single third prize. This year we also actively participated in the seventh BIM competition. It is a good beginning for us to train students’ ability to use BIM technology (Fig.1).

Figure 1. The students from our school of WUST in the BIM competition Last year (2016).
RESEARCH ON PRACTICE TEACHING

Teaching Challenges

At present, there is a tendency for teachers to dominate in the courses of civil engineering. All kinds of courses lack of indispensable connection, whereas some content of course are repetitive. This brings some obstacles to students. After four-year study, students often lack systematic understanding of the profession, leading to the difficulty in getting used to the job [4]. There are growing calls for that to change. The practice teaching of undergraduate stage should unify the professional courses. It should give students deeper understanding of civil engineering and lay good foundation for their employment in the future. Three kinds of practice in Civil engineering undergraduate stage including production practice, cognition practice, graduation practice, and curriculum design as well as graduation project all exist in different problems.

Research motivation

Civil engineering is a complicated system project, which covers many aspects. Adopting BIM technology in construction, stakeholder can insert, extract, update, or modify information during the BIM process at different stages of a building's lifecycle [5]. As a powerful virtual reality technology, BIM can show engineering spot and control process well to make students feel dynamic changes in the project (Fig.2). As discussed above, there are many problems in the practical teaching of civil engineering. Adopting BIM technology to practical teaching leading to a good solution to the challenges. It will enrich and expand the theoretical system of education technology. Even it may overturn the existing teaching model.

The BIM teaching platform can effectively establish close relationship between several courses. BIM include rich information resources and provide three-dimensional perspective. So we can take full advantage of these traits to build the teaching system of specialized courses. In the process of teaching, we can use BIM to create a visual environment for students to enhance their deep understanding of the whole process of project management. It can solve the separation of theory and practice [6]. In addition, all the specialized course will be optimized. At the same time, it will effectively strengthen the cultivation of students’ ability to apply BIM technology.

Encourage students to understand professional knowledge during the school. Deepen the understanding of the profession and industry. Establish teamwork spirit and improve the ability to work together [7]. Promote the exploration of practice teaching in Civil engineering profession and the construction of the training platform in our school, which will avail to create a better learning atmosphere. Students with good professional skills will contribute to their employment.
RESEARCH FRAMEWORK

Research Significance

Considering the requirement of civil engineering profession for talent training, BIM teaching platform can strengthen the relevance and systematisms among professional courses. Meanwhile the repetition and lack of connection form each course caused by the traditional teaching methods are solved. In this way, combining theory with practice and optimizing course content, student will learn the professional knowledge better and possess the ability to use BIM technology.

In view of the difficulties encountered in the implementation of BIM training in colleges and universities, such as high cost of software and teacher training [8], we plan to use the BIM software provided by the Thsware company (Free upgrades are offered every year). Our school will select outstanding students to participate in the Thsware BIM competition every year. In addition, school will organize team of teachers and students to design and establish BIM platform for teaching. With the help of the platform, we will optimize courses to achieve the best teaching effect.
BIM Platform

We use the Tangent and Thsware software to build BIM platform, adhering to the following principles. The platform should be able to relate the curriculum design, experiment and practice teaching effectively. It bases on the direction of concrete structure, steel structure, engineering structure test, engineering economy, civil engineering construction and project management. With the help of BIM platform, we improve and optimize teaching method (Fig.3).

Figure 3. Block diagram of BIM platform.
Establish the evaluation system of BIM technology in the teaching practice and adjust the practice teaching according to actual situation. Ensure students master the application of BIM technology. Through the cooperation with enterprises, school has applied BIM platform into practical engineering and realizes the combination of theory and practice. The reform of practice in civil engineering is an inevitable choice for college to adjust teaching programmer. Three kinds of internship are integrated in the school's network construction simulation lab. Subdivide the internship tasks into small tasks. Curriculum design and structural design are carried out through BIM interactive platforms. This reform is a complement to the information technology and curriculum integration. And it provides a new perspective for teaching. It is helpful for students to understand civil engineering systematically. Students learning through the BIM teaching platform will be able to recognize the importance of teamwork in civil engineering. Our school will brings up high engineering technique and management professionals with practice and complex skills by BIM technology.

CONCLUSIONS

The construction of BIM technology platform is conducive to the interdisciplinary cooperation among civil engineering, architecture, building environment and equipment engineering, water supply and drainage engineering. It responds to the demand of talents training and construction information development.

With the help of BIM, the majorization to the civil engineering professional practice courses will contribute to improving teaching quality and forming professional characteristics. It also provides a new way to eliminate the tendency of homogenization in high school. The author summarized the advantage of BIM based on practice and thinking in the BIM teaching, hoping to other teachers, who engaged in BIM curriculum teaching, have some reference value.

REFERENCES