

Research on Teaching Reform of Architectural Engineering Drawing Based on BIM Technology

Yuan Lu

East University of Heilongjiang, Heilongjiang Province, China

Funding: The general research project of higher education teaching reform of Heilongjiang Provincial Department of education in 2019 “construction and application of Engineering Graphics Teaching System Based on OBE concept and BIM Technology”, subject No. sjgy20190540; Ministry of education industry university cooperation collaborative education project (new engineering construction) “Research on the application of intelligent construction technology in the training of engineering cost professionals”, Project No. 201902102001.

Abstract: The course of architectural engineering drawing is the basic course before the students of civil engineering related majors study the professional courses. It aims to cultivate the students’ ability of configuration, expression, reading and drawing. BIM Technology simulates the real component information of a building through digital information simulation, and flexibly transforms between two-dimensional and three-dimensional, providing a new tool for the teaching of architectural engineering drawing. This paper analyzes the characteristics of BIM Technology and teaching advantages, combined with the current teaching situation of architectural engineering drawing course, puts forward reform suggestions and implementation process, and provides reform ideas for the teaching of engineering basic courses.

Keywords: BIM Technology; Architectural engineering drawing; Reform in education

Publication date: September, 2020

Publication online: 30 September, 2020

***Corresponding author:** Yuan Lu, luyuandf@126.com

In 1970s, the United States first proposed a new concept technology, namely building information model. It aims to reduce costs and improve efficiency through quantitative and visual analysis of construction projects. BIM Technology creates an information platform with which all parties in the construction project can easily communicate, then optimize the design, reduce the cost, shorten the construction time and promote the project

management. It can not only meet the needs of building information development, but also become a powerful tool to solve practical engineering problems^[1].

With the deepening of information technology and education reform in China, the traditional architectural engineering drawing course in colleges and universities is faced with great challenges such as the improvement and renewal of teaching methods and the replacement of teaching places. Architectural engineering drawing course is the basic course of civil engineering related majors. It cultivates students’ professional core basic ability, and the teaching effect directly affects the mastery degree of students’ follow-up professional courses. The introduction of BIM Technology in many professional courses can make students easier to understand and obtain better education results, which is also the common pursuit of the current education reform^[2].

1 BIM technology features

1.1 The representation method changes from 2D drawing to 3D model

Constrained by traditional technology, CAD or other technical methods can only use the combination of various 2D graphics to represent complex architectural forms. The popularization of CAD technology will only improve the efficiency of drawing, but will not change the basic way of expressing space engineering form in plane graphics. BIM Technology directly provides

a three-dimensional data model, which contains all kinds of information in the form of buildings, which is the technical revolution of expression forms. The limitations of two-dimensional graphic representation effect (not intuitive and error prone), the limitations of collaboration in various fields (independent, unilateral representation, many errors and omissions), the limitation of design changes (each graph is independent of each other, link update) is impossible, and the limitations of future maintenance and management of the project. With the continuous emergence of tablet computers, space projection technology, VR, 3D printing and other new technologies, if engineers can easily have terminal equipment that can display BIM 3D models, it will greatly change the traditional production mode of the industry^[3]. In the future, the expression result of architectural form will also be changed from “delivery drawing” to “delivery model”.

1.2 Development of actual production

With people seeking more aesthetic feeling and function of architecture, modern architecture is characterized by complex shape, numerous internal equipment, and pipelines. The traditional two-dimensional drawings are more and more difficult to express these buildings. BIM Technology can easily realize the real description of architectural form through accurate 3D modeling and visualization characteristics. The integrity of information in BIM 3D model makes the drawing work efficient and accurate. Through BIM platform, various engineering drawings meeting the current professional drawing rules can be easily obtained, and specific engineering drawings can be provided at any time as required, such as more section drawings, comprehensive pipeline drawings and comprehensive structural drawings^[4].

2 Teaching advantages of BIM technical drawing course

2.1 Cultivating students' engineering consciousness

Students can use BIM Technology tool software to build 3D building information model and convert buildings from 2D to 3D. BIM building model is displayed in the form of “complete part to whole”, and supplemented by 360 degree virtual roaming to display the space scene inside and outside the building, so as to support the intuitive principle in education and teaching. In the course, 3D building components are fully simulated in combination with architectural scene settings. The display effect of ground objects is very

realistic. Architectural drawings and model components are one-to-one correspondence. Intelligent, intuitive and vivid operation interface and 3D components are the most intuitive indication of graphic projection^[5]. This relationship successfully integrates the actual needs of modern construction industry, restores the whole construction process of the first-line construction site, and cultivates students' engineering consciousness.

2.2 Cultivate students' perceptual knowledge of building structure

BIM Technology is introduced into the process of architectural engineering drawing, and the three-dimensional building information model is constructed by using the Revit software (BIM Technology tool). Combined with the professional requirements, students are allowed to rotate, transform and enlarge 360 degrees. Students can not only use the zoom out and roaming functions to switch buildings, so as to view the buildings from different angles. Through the model, students can also establish the overall concept of space geometry in learning, so as to understand the fun of design, creation and innovation, improve students' space thinking ability, and cultivate students' perception and understanding of building structure.

2.3 Improve the information education ability of construction engineering drawing process

The introduction of BIM Technology into the classroom means the introduction of building information and models into the classroom, which should make classroom teaching more intuitive and concise, and solve the problem of disconnection between knowledge theory and practice in traditional courses. It can not only update the teaching concept and reform the teaching method, but also help to organize the course. It can also keep up with the development trend of construction information technology era, cultivate new human resources in the construction industry, promote the development of construction teachers, and promote the cultivation of applied technical talents in professional colleges.

3 Teaching status of architectural engineering drawing

3.1 The content of traditional education is inconsistent with modern engineering technology

Traditional architectural engineering drawing textbooks mainly focus on descriptive geometry and CAD content,

but 3D view widely used in BIM Technology has not attracted enough attention. However, with the progress of construction technology, these traditional education contents no longer meet the requirements of personnel training, so the education content is quite different from the actual content. The teaching content of CAD is mainly based on two-dimensional plane, which can not be converted into three-dimensional, which makes it difficult for students to understand. Some traditional education contents have no serious relationship with actual production. The knowledge points describing geometry (such as face changing and rotation methods) are not used in the construction industry, while some knowledge points such as intersection lines are too complex and abstract. As a result, the learning process of students is fuzzy and boring, and the actual work is less involved in more complex building model learning^[6]. At present, most of the computer aided drawing courses only learn the two-dimensional features of AutoCAD and other software in their training courses, and almost do not contain the content of 3D modeling, while the advanced BIM Technology pays more attention to the application of 3D modeling.

3.2 The teaching method is not flexible enough

The traditional teaching method is based on blackboard + triangle + PPT. Full of teaching methods make students less interested in learning. In the traditional teaching method, two-dimensional planning diagram is used to describe the plane, vertical line and cross-section, and the three spatial drawings are not explained separately. Three-dimensional transformation makes the classroom content abstract and difficult to understand. In most of the classroom teaching of PPT interpretation, teachers are easy to project the courseware, the drawing process is displayed quickly and the display effect is poor. Mechanical demonstration will also limit the teacher's explanation, which will not help to enlighten and expand the curriculum, will not help the interaction between teachers and students, and will greatly reduce the teaching effect. However, the multimedia courseware with fixed content and scene is difficult to adapt to the dynamic classroom teaching situation. If the training situation changes, the training content and method cannot be adjusted in time.

3.3 Less space to display

The course of architectural engineering drawing is the first professional basic course that college students will encounter when they enter the University, which is of great help to the professional drawing in the future. The conversion between two-dimensional

and three-dimensional drawing process requires high spatial imagination, so it is difficult for students who lack spatial imagination or show three-dimensional imagination and do not learn the process. Especially for the content that is hard to imagine only relying on plane, spatial representation can better understand knowledge points, while traditional education does not involve or rarely includes spatial representation. For example, intersecting lines, etc. Students generally report that it is difficult to imagine from the plane, so the education effect is poor.

3.4 Freshmen lack professional recognition, which limits the learning effect

As a basic professional course, architectural drawing is usually lack of professional foundation and intuitive understanding of architectural form and key components for freshmen who just enter university. In the learning process, it is difficult for students to read two-dimensional drawings and determine the actual shape and components of buildings only with projection knowledge. Relevant surveys show that most students have limited ability to read floor plans and can not match floor plans with building objects exactly, and the thinking process takes a lot of time.

4 Suggestions and implementation process of BIM architectural engineering drawing teaching reform

4.1 Suggestions for teaching reform

4.1.1 Change the traditional educational concept

In the course of architectural engineering drawing, the classroom teaching method combined with BIM Technology is novel, rich in content and intuitive. By making full use of BIM technology to construct virtual simulation building model scene and present the design intention of engineering drawing vividly and intuitively, the course design is realized. Deepening students' understanding of knowledge points has a positive effect on the cultivation of students' spatial logical thinking and creativity.

4.1.2 Changing the traditional education system

The application of BIM Technology enables students to understand the knowledge presented by dimension model, so that they can internalize the knowledge better. Theory and teaching practice are fully integrated to change and innovate the traditional education system. Starting from the level of theoretical knowledge, skill level and engineering quality, students show 3D

modeling ability, comprehensive application knowledge ability and coordination ability among specialties, and improve students' structural innovation and industrial competitiveness.

4.1.3 Innovative educational content

The importance of innovation in teaching content is self-evident. At present, most of the knowledge points in the course of architectural engineering drawing in Colleges and universities are deep and abstract, and the jargon is difficult to understand. The education contents that meet the requirements of the course are compiled, and the information and data related to the building model, scene and function are established, and the architectural model is comprehensively analyzed. The new education content can not only help students quickly learn the structure of buildings, but also expand their knowledge to the greatest extent, so that students have a full understanding of architecture, increase their interest in learning, and expand their innovative thinking.

4.1.4 Training mode update

The traditional teaching mode is "ppt + teacher lecture". The training mode is single. BIM based tool software, based on PPT + teacher training, video, computer room synchronization training, computer operation, etc. Technical means make multimedia courseware become secondary education, which improves the efficiency of classroom teaching, helps students develop innovative thinking ability, and lays a solid foundation for the follow-up course learning.

4.2 Implementation process of teaching reform

4.2.1 The education of demonstrating knowledge points in class

Before class, the teacher should prepare the general basic components of the building and the relevant models of relevant building model information data materials. In class, students are instructed to input model data to create 3D models of building components. In the Revit software (BIM Technology tool), the basic components of buildings (such as external walls, interior walls, floors, etc.) are set by the classification system as the "general category" of building element attributes and input data. These steps are based on the logic of buildings, which makes it easy for students to understand building components and enrich component specifications in the classification system. Take the wall as example. There are partition walls and load-bearing walls. By introducing BIM Technology into classroom teaching, students will gradually establish a preliminary

design framework, improve students' spatial thinking ability with fuzzy concept function relationship, and cultivate students' perception and understanding of building structure.

4.2.2 Process implementation process analysis

Collect information before class. The architecture model provided by BIM Technology needs information and data support. Students are gradually building the model skeleton in the Revit software according to the textbooks provided by teachers. Therefore, teachers must be ready to collect textbooks before class. Firstly, the model project is selected according to the training requirements, and then the relevant building model information data, such as CAD construction drawing and model construction information, are collected according to the selected project.

Virtual practice. Teachers and students have created a BIM architecture model on the Revit software platform. The model is presented in the form of a whole, supplemented by 360 degree virtual roaming to provide students with an immersive experience. By switching the functions of 3D transformation, rotation, scaling and roaming, we can view the building model by switching different perspectives, so as to improve students' spatial thinking ability and cultivate students' perceptual understanding of building structure.

Feedback and evaluation after class. Students are required to complete their homework every week. The content is related to the process which accounts for 60% of the total score. The remaining 40% is used for final examinations and follow-up courses, so that students can repeatedly practice the knowledge and skills of the course.

4 Conclusion

In this paper, BIM Technology is introduced into the course of architectural engineering drawing, in order to better convert the plan into space and make students understand it more easily. As a new technology in the construction industry, BIM plays an important role in reducing construction costs and improving production efficiency, and will vigorously promote the development of construction industrialization. It is important and urgent to bring BIM concept and technology into university curriculum education. However, from the current education situation, whether BIM is incorporated into the professional curriculum system or applied to the teaching of architectural engineering drawing, there is no mature model to refer to, so teachers need to think more deeply about the teaching process.

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