

Research on Teaching Design of Building Architecture Based on Bim Technology

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Abstract: under the Background of Today's Information Age, the Application of Bim Technology in Civil Engineering Teaching and Assessment Has Become an Inevitable Trend. However, There Are Still Some Problems in the Application of Bim Technology by Teachers in the Course of Building Architecture, Which Leads to the Ineffective Application of Bim Technology. in View of This, This Paper Aims At the Problems of Students' Lack of Subjective Initiative, Teachers' Heavy Workload and Unreasonable Design Arrangement in the Course Design of Housing Architecture, and Combines Bim Technology to Carry out Teaching Reform on the Course Design of Housing Architecture, Adjust the Design Arrangement, Make the Course Design Closely Linked with the Course System, Conform to the Development Trend of the Construction Industry, and is Worthy of in-Depth Exploration in the Future Teaching Reform.

1. Introduction

Bim is the Abbreviation of Building Information Modeling, Which is All Called Building Information Model. It is the Direct Application of Digital Simulation Technology in Building Engineering and Integrates All Kinds of Engineering Data and Information Materials Related to Shared Information of Engineering Projects [1]. Most Courses in Architectural Schools in Colleges and Universities Are about Theoretical Knowledge. Although Students Have Passed the College Entrance Examination and Have Certain Basic Cultural Knowledge, They Still Need Strong Spatial Imagination and Practical Experience in Order to Rapidly Sublimate Theoretical Knowledge in the Face of Professional Theoretical Knowledge [2]. the Course Design of Housing Architecture is the First Independent Architectural Design Carried out by Civil Engineering, Engineering Management and Other Civil Engineering Non-Architecture Major Students. the Aim is to Cultivate Students' Imagination and Practical Cognitive Ability of Architecture, So as to Further Strengthen Students' Independent Application of Theoretical Knowledge, Technical Standards, Design Specifications and Other Professional Skills. Bim Technology Integrates All Kinds of Relevant Information Provided by Engineering Designers and Technicians, and Provides Basic Data for Cooperation among Various Specialties of Engineering Projects [3]. It Not Only Facilitates Construction Simulation, Structural Analysis, Cost Analysis, Etc., But Also Makes the Teaching Content Clear and Easy to Understand, Thus Effectively Improving the Effectiveness of Housing Architecture Courses. Therefore, Many Architecture Teachers Have Strengthened the Application of This Technology. Applying Bim Technology to the Course Design of Housing Architecture and Changing the Examination Method of Course Design Are the Key to Improve Students' Operation Ability and Adapt to the New Requirements of Building Informatization.

2. The Current Situation of Teaching Design of Building Architecture Course

As a Practical Teaching Link of Housing Architecture, Curriculum Design is Not Only the Comprehensive Embodiment of Students' Curriculum Theory of Housing Architecture, But Also an Important Link for Students to Further Understand the Theory of Architectural Design, Understand the Steps of Architectural Design, and Learn Architectural Design Standards [4]. Bim Technology Uses Building Information Components to Create a Three-Dimensional Model to Achieve an All-Round View of Building Engineering. It Has the Characteristics of Information Completeness,

Information Relevance, Information Consistency, Visualization, Coordination, Simulation and Optimization. the Application of This Technology in the Construction Industry is Another Change Following the Replacement of Hand Drawings by Architectural Cad, Which Makes the Whole Building Visible Before Construction, Controllable during Construction and Manageable after Construction [5]. in Order to Draw a Complete Construction Drawing of a House, It is a Comprehensive Application of Theoretical Knowledge of Engineering Drawing, Computer-Aided Design and House Architecture Courses.

2.1 Students Lack Subjective Initiative

Although the Curriculum Design of Housing Architecture Integrates the Contents of Previous Cartographic Courses, It Has Little Connection with Subsequent Courses. the Design Adopts the Mode of Manual Drawing or Cad Drawing Before Manual Drawing, Which is Heavy Workload and Takes a Long Time. Many Students Are Unwilling to Spend Time Thinking and Studying the Design Content. When the Details Change, the Whole Drawing May Be Affected. the Course Design of Housing Architecture is Usually One Week. Repeated Revision of Drawings Results in Too Large Quantities of Work, and the Final Results Are Not Satisfactory [6]. a Considerable Part of the Content is Displayed in the Form of Two-Dimensional Graphics, Sometimes Supplemented by Simple Animation. in the Teaching Process, Students Are Required to Associate Three-Dimensional Models According to the Two-Dimensional Graphics. If the Three-Dimensional Models Cannot Be Imagined, the Learned Content is Difficult to Understand and Remember Deeply. Especially When the Topics Are the Same, the Design Lacks Depth and Originality, the Similarity Rate is High, and Students Download Drawings Directly from the Internet to Try to Muddle through. Therefore, the Quality of the Classroom is Extremely Limited and the Information Cannot Satisfy the Students' Thirst for Knowledge. Although This Teaching Method Can Be Divided into Two-Dimensional and Three-Dimensional and is Dynamic, It Can Make Students Understand Part of the Knowledge, But It is Limited to the Classroom. Once the Classroom is over, the Students Will Forget It Very Quickly.

2.2 The Workload of Teachers' Guidance is Heavy

With the rapid development of the real estate industry, the enrollment of civil engineering majors is booming. There are 40 students in a standard class, and a teacher must guide students in at least two classes. During the whole design process, the teacher should guide each student's building plan, building elevation and building section at least three times, so many guiding tasks make the teacher overwhelmed and unable to do his best. However, the teaching of this course is still one-to-many at present. Under the condition of limited teaching resources, it is impossible for teachers to give targeted guidance to every student. If students drop out of the course, there will be a problem that they cannot keep up with the teaching situation [7]. Students can't really grasp the concrete shape and internal structure of the building during the drawing process, and can't imagine the actual shape and internal structure of the building during the drawing of the plan, which leads to the final result of the architectural design far from the rational result. Teachers explain a large amount of theoretical knowledge, supplemented by PPT to display a large number of pictures or fragmentary animation, it is difficult for students to concentrate for a long time, which is not conducive to guiding students to actively understand, think and associate, and affects the teaching effect.

2.3 The Design Schedule is Unreasonable

There are two arrangements for the time of curriculum design. One is to arrange a week at the end of the term for students to design and draw in designated classrooms after the theoretical course of housing architecture is finished. Many students can't concentrate on curriculum design, let alone hand-in-hand guidance and supervision of students' drawing. In this case, students' problems cannot be effectively solved. In addition, in the process of design teaching, students usually need to use their spare time to complete the drawing work, teachers cannot guarantee the arrangement of time, and there are some deficiencies in the guidance, which leads to the decline of the design quality of some students. The other is the synchronization of design and housing architecture. Students find

their own classrooms or draw drawings in dormitories in their spare time. Teachers guide the design between classes. The disadvantage of this arrangement mode is that the teacher's guidance time cannot be guaranteed, and many students wait until they finally have to hand in the drawings before they rush to work, resulting in poor design quality.

3. Exploration of Curriculum Design Reform Combining Bim

3.1 Bim Overview

BIM is to establish an engineering data model integrating various related information of construction projects through three-dimensional digital technology, and to express the whole process data of the project in detail [8]. BIM technology transforms the traditional process of drawing two-dimensional construction drawings into the simultaneous generation of two-dimensional drawings while establishing a three-dimensional model. Each operation of the software user in the interactive interface can be directly and synchronously reflected on the two-dimensional drawings and the three-dimensional model [9]. And the written text information is converted into vivid and three-dimensional interactive construction site simulation scenes, which can effectively solve the puzzle of not being able to enter the construction site for teaching, and can better solve the problems that the curriculum theory and practice cannot be connected, and students lack space imagination ability. Colleges and universities in our country are actively exploring the teaching reform of integrating BIM technology into the curriculum. The most commonly used method in teaching now is to convert written words in the curriculum into vivid and three-dimensional interactive construction site simulation scenes. Plans, elevations, sections and three-dimensional figures drawn by Revit software on the BIM platform are all interrelated. After changing one figure, other figures are automatically changed. This can not only save time, but also achieve the effect of mutual checking and avoid making changes for the consistency of the contents shown in the drawings. Therefore, the use of relevant software on the BIM platform in course design is the best way to learn the knowledge and practice of housing architecture courses.

3.2 Combining Bim Technology in Curriculum Design Teaching

“Housing Architecture” is a professional foundation course for architectural specialty, and is the foundation for the following professional courses such as “Architectural Mechanics” and “Architectural Construction” [10]. The BIM technology is applied to improve the learning effect of this course, explore the teaching mode suitable for this course, so that the course of “Housing Architecture” is no longer theoretical. Combining with daily teaching practice, a teaching mode based on BIM technology and integrating theory with practice is constructed (Figure 1). Changing the traditional manual drawing assessment method into modeling assessment on revit platform can not only enhance students' practical ability, but also enable students to grasp the rationality of the designed buildings in time, find out the deficiencies and errors in time and correct them in the modeling process. The combination of two-dimensional graphics, three-dimensional models and animation demonstration can deepen students' understanding of knowledge points through various ways and means. BIM technology can be used throughout the learning process to enable students to understand the functions of BIM. BIM technology can be mastered through practice to guide students to apply BIM technology to engineering practice and innovation activities, so as to achieve the purpose of supplementing the training of professionals in the construction industry who are in urgent need of BIM technology.

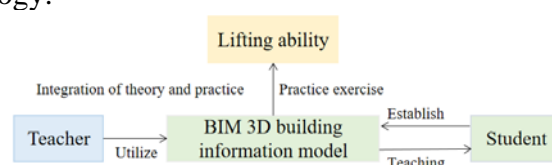


Fig.1 Bim-Based Teaching Model of Integrated Theory and Practice for Housing Architecture

After the BIM technology is integrated into the teaching system, the course design of housing

architecture, as a practical course for students to use BIM technology for complete architectural design for the first time, plays an important pivotal role in the course system because it closely follows the theoretical course of cartography. Its position in the course system is shown in Figure 2.

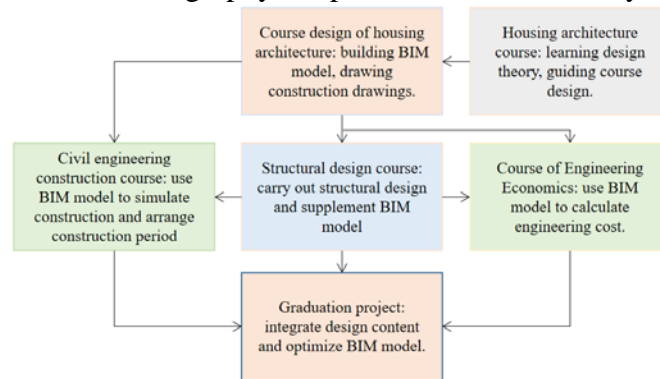


Fig.2 Task Decomposition Flow Chart of Architectural Design

The practice teaching under this mode requires the school laboratory to provide computer facilities for learning. Since the school informatization teaching has been implemented for many years and more investment has been made in informatization, it meets the most basic hardware facilities for practice teaching. However, it is necessary to update computer equipment on this basis to meet the hardware requirements for BIM technology teaching. In the course design, the BIM modeling software Revit is used to draw the building plan first, and the three-dimensional building model is drawn after the guidance of the teacher. Then the two-dimensional figure generated by the three-dimensional model is modified into a standard construction drawing according to the requirements of the drawing specification and printed out as a homework. On the basis of teachers' reform of teaching methods, students can further consolidate the theoretical knowledge learned in the early stage. Teachers require students to use BIM software to build corresponding individual components after learning the theoretical knowledge of each module, and add new components as new knowledge is learned. Under this teaching situation, students can fully combine theoretical knowledge and practical learning. In addition, the application of BIM technology can greatly reduce the workload of students in drawing work, set aside more time to think and answer, and promote the development of housing architecture curriculum education reform in many aspects.

Curriculum design starts in the 6th week after the explanation of graphic design content in the theoretical course of housing architecture. The design process adopts the method of combining centralized guidance in the computer room with students' spare time drawing. The teacher needs to guide 2 classes in the computer room every week and open the computer room for students to learn on their own during the rest of the time. The schedule is shown in Table 1.

Table 1 Instructional Arrangements For Curriculum Design

| Time | Guidance content |
|---------|---|
| Week 6 | Inspire design ideas and review Revit functions |
| Week 7 | Watch the single-layer model and guide the preliminary plan |
| Week 8 | Determine preliminary plan |
| Week 9 | Check the complete model of the building and propose amendments |
| Week 10 | Check the building plan |

The course design of housing architecture is based on the practical exercise of course learning. Students complete the plan, elevation, section and structural details of the building on the basis of mastering the basic theories and drawing methods. The information to be expressed should be coordinated and consistent on each drawing. However, since the drawings are independent of each other. Therefore, BIM platform teaching is introduced into the curriculum design to extend the cycle of curriculum design, so that the curriculum design changes from the traditional one-week centralized drawing to the decentralized modeling of the whole curriculum cycle of housing architecture, combining the curriculum assessment with the results assessment. After the design task is assigned, the computer room will be opened for 8 weeks after school to become a design

classroom. Teachers go to the computer room at a fixed time every week to check the results of the student stage, to guide the students' personal questions individually, to summarize and implement the common problems in the design. Teachers are required not only to know the theoretical knowledge of BIM, but also to use Revit and other modeling software to build models, which determines that BIM practice teaching needs to invest more manpower and financial resources to ensure the long-term and sustainability of BIM technology practice teaching.

4. Conclusion

BIM technology has good advantages in application. With the continuous development of the construction industry, more and more information technology has been promoted in the construction field. However, due to the limitations of practical teaching conditions and teachers' own abilities, their application in teaching is limited to some extent. Therefore, only by timely creating practical teaching conditions, strengthening the training of teachers and better applying BIM technology in teaching, can the overall quality of teaching be improved and the order and efficiency of teaching be guaranteed. The introduction of BIM software Revit into the curriculum design of housing architecture makes the curriculum design closely linked with the application teaching of BIM series software in the curriculum system. As a result of the design, the architectural model can be used in subsequent professional courses and graduation designs, so that they pay more attention to curriculum design. Through the introduction of BIM technology into teaching, students can better learn and apply theoretical knowledge, enhance competitiveness, and become professional and technical personnel to meet the needs of social development.

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