

Research on Reform and Innovation of Curriculum System of Construction Equipment Specialty based on BIM application

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Abstract: BIM technology entered China at the beginning of this century and has played a prominent role in many industries. Firstly, it is applied in design enterprises, and then extends to construction enterprises, with emphasis on construction engineering. As the main force in the development of the construction industry, construction enterprises pay more and more attention to the learning and application of BIM in enterprises. BIM technology will bring more possibilities to construction equipment. With the development of The Times, the original teaching technology has been unable to meet and achieve students' future career needs and goals. This paper follows closely the steps of teaching reform, With the application of BIM technology as the entry point. The reform and innovation of BIM are deeply integrated into the professional core courses, curriculum design and graduation design, etc, in order to keep up with the industry demand and employment guidance, improve the social competitiveness of student's employment.

Keywords: BIM; Construction equipment; Curriculum system; Reform and innovation.

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1 Development status and prospect of BIM technology

Building Information Modeling, referred to as BIM,

it is a new tool for architecture, engineering and civil engineering. BIM technology is a data tool applied in engineering design, construction and management. It can integrate the data and information model of the building, sharing and delivery throughout the full life cycle of project planning, operation and maintenance. The construction subject of all parties can carry out collaborative work based on BIM, improve work efficiency, save resources, reduce costs, in order to achieve sustainable development. Since this technology was proposed in 2002, it has brought great changes to the construction industry in Europe, America, Japan, Singapore and other developed countries. Recognizing the advantages and development potential of BIM technology, THE International Construction Association (UIA) has promoted BIM as one of the policy recommendations for professional practice of architects globally. The American Institute of Architects warned in 2006 that architects who did not understand could lose their competitiveness or even their jobs in the near future. It is not hard to see that the ERA of BIM has arrived.

China is one of the world's largest construction markets. As for the promotion of BIM technology in China's construction industry, relevant government departments have made a lot of attempts and efforts. In recent years, more and more BIM promotion policies have been launched. The Ministry of Science and Technology of the CPC Central Committee has clearly stated in the key project of the National Science and Technology Support Plan "Research on Key Technologies of Modern Architectural Design and Construction" in the 11th Five-Year Plan that

BIM technology will be further studied, Improve collaborative work platform to improve work efficiency, production level and quality. The Ministry of Housing and Construction clearly proposed to basically realize the popularization and application of information system of construction enterprises during the 12th Five-Year Plan period, accelerate the application of BIM technology in engineering. In 2017, the Ministry of Housing and Urban-Rural Development issued the National Standard "Construction Application Standard of Building Information Model". Since then, Beijing, Shanghai, Shenzhen, Guangdong and other regions have successively issued the policy documents of applying for construction of government projects and adopting BIM technology in bidding.

Although BIM in construction industry started late in China, the application of BIM technology is still in the initial stage, progress is still difficult, but also obtained certain research results and practical experience. In particular, a number of successful BIM research and demonstration projects have emerged in recent years, accelerated the teaching and application promotion of BIM, and promoted the informatization process of China's engineering construction industry.

BIM is a brand new technology and concept, subverting the original way of thinking and working in the construction industry, realizing the Informatization and openness of project management, solved the problem of information loss in the stages of project planning, design, construction and operation fundamentally. It can accelerate the project production speed, improve the project quality, shorten the construction period and reduce the project cost, ensure the effective use and management of engineering information within the project life cycle, we will significantly improve project quality and construction efficiency, and increase the benefits of the construction industry. This brand new technology has brought new demand for BIM talents, and it is urgent to keep up with the industrial demand and employment-oriented talent training.

2 Application of BIM technology in construction equipment engineering

The traditional design mode based on CAD has been the mainstream of the construction industry, but its existence lacks the necessary intuitiveness, many

obstacles in information communication, long design cycle, low work efficiency, Inevitably, mistakes, omissions, gaps and other problems occur in the design process, resulting in unnecessary rework and waste, to the operation and maintenance safety of the great hidden danger when serious. With the emergence of BIM, many practitioners have clearly felt the impact and benefits brought by it.

Building in "Building Information Modeling" is not a Building in the narrow sense, it represents all kinds of civil engineering construction projects. BIM is the complete and full information expression of the building, which can support the whole life cycle of the building. The full life cycle of a building simply refers to the full cycle process from material and construction production, planning and design, construction and transportation, operation and maintenance to demolition and treatment (waste, recycling and reuse, etc.), it can be roughly divided into four stages: planning, design, construction and operation. BIM technology can realize the integration of building information, all kinds of information in the whole life cycle of the building is always integrated into a 3D model information database, therefore, participants in various stages of project planning, design, construction and operation can work together based on BIM, effectively improve work efficiency, save resources, reduce costs, in order to achieve sustainable development.

Based on the specific application of BIM in construction equipment engineering, in the project planning stage, whether the project plan is technically and economically feasible should be generally studied according to the demand. Using BIM can realize the pre-simulation and demonstration of multiple schemes, and then comparative analysis, obtain the best solution, shorten the construction period, strictly control the cost and investment.

During the design phase, The digital design mode of BIM replaces the traditional drawing mode by the way of database. In this way, the information in the construction project can be quickly and accurately inquired, deleted, updated and saved. In the pipeline system design of construction equipment engineering, Revit software has more advantages than the traditional design method, can reduce the duration, reduce the design of a lot of adjustments, clear and direct equipment construction materials are prepared for the subsequent construction, which reduces the

difficulty.

During the construction phase, BIM can simulate the real scene in the construction stage of the project and build the completion model for the project, through this process, we can find out in advance the problems that may be encountered in the project, and provide corresponding solutions in time. For example, models in the construction process need to be fully inspected for pipeline collisions, using BIM to solve the pipeline collision problem and optimize the pipeline layout in the model according to the results of the collision report, moreover, the specific information of pipeline location can be obtained more accurately, which is convenient for the construction personnel to accurately locate the pipeline, to a certain extent, it facilitates the prefabrication of pipelines and other related equipment. After coordinating and optimizing the construction project, BIM technology can provide corresponding drawings according to the needs of the project. For example, Integrated pipeline diagram, collision test report and proposed improvement plan, etc.

Based on BIM operations management, the integration of information in a variety of data before the relevant information to be Shared. Material documents necessary for the maintenance phase, such as construction team, completion acceptance form, inspection qualification report, product production list and other information, shall be imported into the BIM model, to ensure that the data can be reviewed at any time and kept intact, in this way, the integrated information and data can be used for prediction and analysis when the relevant situation is not very clear, so that emergency treatment can be carried out for emergencies. In the absence of an emergency, BIM technology can also be used for relevant drills and response tests. Because of its visual characteristics, In the construction project to transition or personnel changes, not lead to lack of information, can guarantee the sustainability of complete construction project operation maintenance.

The development of BIM technology is the product of information and intelligent development, With the construction industry attaching great importance to low energy consumption, low pollution and sustainable development, and with the increasingly fierce competition in the same industry abroad, The mode of work and technical means in the traditional era can no longer meet all kinds of challenges.

Urbanization process in China is gradually speeding up, and the construction industry is also in a stage of rapid development, information technology has been the development direction of China's construction industry at this stage, the use of BIM technology in the construction industry has become a historical necessity.

3 Exploration of teaching path of construction Equipment specialty

Construction equipment engineering course is a basic course of engineering technology in architecture, civil engineering, engineering management and other majors in many colleges and universities in China. The courses are arranged in three main directions: heating ventilation and air conditioning engineering, building water supply and drainage engineering, and building electrical engineering, it is not only a comprehensive engineering discipline, but also a professional course closely combined with theory and practice.

The purpose of the course is to help students learn and master the basic theories and basic knowledge of building physical environment and environmental control system, acceptance basic training of the construction equipment system design, debugging and running management and other aspects, have the preliminary ability to design, construct and install basic building equipment, analyze and solve practical problems of the project, etc, make reasonable construction equipment engineering design, construction and management, cultivate students with comprehensive consideration and reasonable handling of the relationship between various construction equipment and the main building ability.

In recent years, the demand for BIM talents in construction projects around the country has been increasing, the traditional teaching of construction equipment engineering has been unable to meet the requirements of future development. In the teaching of architectural engineering, we should combine the needs of The Times, pay attention to the training of BIM technical personnel, integrate BIM technology into the teaching of construction equipment engineering, so that students can better learn and master this course, improve the quality of teaching, enhance students' understanding of theoretical knowledge, enable students to have the

necessary knowledge of construction equipment and construction design ability in the future work. This paper tries to explore the teaching path of construction equipment engineering from the following points.

3.1 Cultivate students' application awareness of BIM information model

Times are developing and technology is advancing. BIM technology plays a prominent role in many industries and is bound to play more possibilities in the construction equipment industry. When teachers teach students the basic knowledge of construction engineering equipment, they should pay attention to and understand the development direction and trend of the equipment system in a timely manner, get in touch with the latest situation and information, and convey these contents and information to students. As a new technology, BIM technology is the latest demand of construction equipment course teaching. In the traditional teaching of architectural engineering, most teachers explain engineering drawing knowledge to students through language, or express projected information through line construction, the teaching method is relatively unitary. Combined with BIM technology teaching, the building model can be shown through three-dimensional graphics, deepen students' understanding of knowledge, improve their interest in learning, cultivate students' awareness of the application of BIM information model, and help students form BIM thinking.

3.2 Organically combine BIM technology with the core curriculum content of construction equipment major

BIM technology can be applied based on BIM core modeling software, BIM core modeling software includes architecture and structural design software (such as Autodesk Revit series, Graphisoft ArchiCAD, etc.), design software for electromechanical and other systems (such as Autodesk Revit series, Design Master, etc.), etc. In addition to the core modeling software, the implementation of BIM also needs the support of a lot of other software, for example, the analysis software based on BIM model, include structural analysis software (PKPM, SAP2000, etc.), construction schedule management software (MS Project, Navisworks, etc.), deepening design software (Xsteel, etc.) for making processing drawings Shop Drawing, budget software, equipment management

software, visualization software, etc. Among them, Revit MEP products of Autodesk Revit series are designed to provide BIM solutions for construction equipment (water, electricity and heating). Taking the core course of construction equipment major as the reform object, BIM technology is organically combined with the core course content of the major, by revising teaching documents such as teaching outline and teaching design, students are "input" the theoretical content of information technology to present three-dimensional, intuitive and virtual building equipment components. Considering the application of BIM in construction enterprise, BIM education in construction enterprises, BIM technical personnel requirements of construction enterprises and other factors into comprehensive consideration, integrat BIM application into the original curriculum and develop core curriculum teaching design.

3.2 Integrate BIM technology into practical courses of construction equipment speciality

Taking practical courses of construction equipment major as the reform object, BIM technology is applied to the corresponding course design link of core courses of the major, and students are allowed to use software to express three-dimensional drawings of course design and test the effect of "input" of theoretical teaching in the way of "output". Choose professional core course of corresponding design to test students practice the application of BIM technology ability, such as using BIM thinking to plumbing system design, so that the students have basic ability to solve the water heating pipeline collision. Based on the modeling model and data of green building in BIM model, the modeling design of water heating pipeline can be carried out and corresponding construction drawings can be drawn. During drawing modeling, the collision problem of pipe network can be clearly identified by virtue of the excellent virtualization technology, analytical capability and statistical capability of BIM technology, find out the contradictory position, and adjust the pipeline and equipment, so as to meet the relevant requirements. The combination of theory and practice to test the practical effect of the teaching system reform can improve students' learning interest and comprehensive practical ability, ensure the good combination of students' theoretical study and practice, and lay a foundation for their future work

related to BIM technology.

4 Apply BIM technology to graduation design

The graduate design of architectural equipment major requires students to draw construction drawings and compile the design specifications of the design. This can be the object of reform and BIM technology can be applied to simulation practice engineering design. Graduation design should be combined with the real situation, in order to help students master professional knowledge and practical application more effectively. In practical operation, teams can be established, project models can be built using Revit, construction sites can be simulated, achievements of various stages can be sorted out, and results can be submitted according to graduation design requirements. Or keep the traditional graduation design results according to the relevant regulations of the university, and then add and improve the results with the combination of BIM technology. Such graduation design can be used to test the teaching effect of theoretical teaching and practical teaching, improve the application level of BIM technology, and enhance the market core competitiveness of students majoring in construction equipment.

There is a long way to go in training BIM talents. It is a must to innovate training mode and strengthen practice. With the application of BIM technology as the entry point, this paper conducts innovative research on curriculum system reform in the direction of construction equipment specialty, follows closely the industrial demand and employment guidance, and improves the social competitiveness of students' employment, hoping to provide reference for the practical teaching implementation of BIM talent training in colleges and universities.

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