

# Research on Teaching Practice System Based on BIM

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**Abstract:** Building information modeling (BIM) course is a subject course integrating project management course and BIM Technology. BIM-based engineering project teaching is different from traditional engineering project management. It has many advantages such as information creation, information management, digital management of information sharing, and so on, which improves the integration of project management as a whole. Therefore, it is crucial to improve the curriculum system of colleges and universities by setting up BIM courses, and to integrate BIM knowledge into the curriculum system. Setting up BIM courses and integrating BIM knowledge into the curriculum system have also been the highlight for colleges and universities. The engineering management major of the university is combined with the BIM curriculum system to adjust the relevant talent training plan. Foreign countries have gradually integrated BIM technology into the classroom teaching system, and domestic curriculum teaching is undergoing a reform and is under development. Through a systematic link between theory and practical education, a targeted, accurate, and efficient characteristic curriculum system for engineering management specialty has been developed.

**Keywords:** BIM technology; Course teaching; Practice system

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## 1. Introduction

In view of the development of BIM technology, the key factor limiting the promotion of BIM technology is the lack of BIM talents. The application of BIM technology in the construction industry mainly focuses on the design unit, and gradually expands to the construction unit and asset management unit. Through cost consulting units, construction units and real estate units, engineering management majors cultivate professional knowledge such as project cost management in the bidding stage and construction process, project management in the construction stage, and asset management in the operation and maintenance stage. Therefore, it is necessary to set up BIM courses and integrate BIM knowledge into the curriculum system. However, it is difficult to set up BIM courses or integrate BIM knowledge into the curriculum system efficiently <sup>[1]</sup>. At present, foreign countries have gradually integrated BIM technology into classroom teaching and carried out a series of reforms and practices. A few universities in China, mainly architectural universities, offer BIM related courses <sup>[2]</sup>. BIM is mainly provided in the engineering management major. It is particularly urgent to combine the BIM of the engineering management major of the school with the existing curriculum system, adjust the talent training plan, and cultivate more excellent professionals for the society.

## **2. Teaching course characteristics based on BIM**

First of all, BIM course is an interdisciplinary course integrating project management and BIM technology. It is construction project management based on BIM technology. Different from traditional project management, project management based on BIM has many advantages. Digital management of information creation, information management and information sharing can greatly improve the integration of project management. It is also reflected in the cross-connection of construction project management based on BIM technology, and the application of various elements in the whole life cycle of buildings <sup>[3]</sup>. Secondly, BIM courses integrate professional theories and knowledge such as construction engineering management and BIM technical knowledge, BIM 5D software operation, management, and comprehensive application skills in housing construction, building structure, engineering construction, and so on. It can cultivate students' comprehensive professional knowledge and skills, including organization, engineering budget and cost management, BIM adoption, BIM modeling, BIM measurement, and improve students' knowledge systematization and maturity <sup>[4]</sup>. The most important thing is to learn the purpose of BIM courses and how to carry it out in actual practice. In the teaching of computer operation, the main purpose is to carry out the operation and application of BIM5D, strengthen the connectivity between theory and practice, cultivate students' ability to apply BIM technology to practical engineering project management, and strengthen students' comprehensive abilities.

## **3. Importance of BIM courses**

The school firmly establishes the starting point for cultivating BIM technical talents, attaches great importance to the fundamental task of building morality and nurturing students, takes the education of ideals and beliefs as the core, with socialist core values as a guide. Cultivating college students' mentality at the beginning stage of talent training provides the society with many BIM professionals with both ability and political integrity <sup>[5]</sup>. BIM talent training implementation and innovation project management is the core specialty of the school's project management and service professional group. Combined with the characteristics of school city construction, BIM courses emphasizes the combination of engineering technology, economics and information technology, and offers practical courses and computer courses. In the process of application, we should strengthen students' practical ability and computer skills, so that a comprehensive development of engineering skills, management skills, production skills, and learning skills can be achieved. At the same time, we should actively adapt to the needs of local economic and industrial development, employers and teachers can be consulted for the development of training plan <sup>[6]</sup>. Like fresh graduates, the training plan should be adjusted in time. The theoretical and practical education should be connected in an orderly manner, forming a targeted curriculum system for engineering management majors. The advantages of offering BIM courses lie in the complete professional course system and the professional requirements for BIM technology. Building engineering drawing, building construction, reinforced concrete and masonry structures, and installation engineering drawing identification and construction courses can cultivate students' drawing understanding skills <sup>[7]</sup>. Students should have the knowledge to complete professional modeling, and be able to complete 3D modeling using appropriate software. Project construction organization and progress management can help students develop progress management skills, and students can use progress management software to manage their projects.

## **4. Research measures of teaching practice system based on BIM**

### **(1) Develop college students' BIM technology skills through competitions**

Various types of BIM technology competitions are held every year. BIM application technology competition and BIM graduate design innovation competition make it stand out from other types of projects <sup>[8]</sup>. BIM certifications are divided into comprehensive and professional categories, including

modeling technology positions, project management positions, cost management positions, decoration engineers and other types. These certifications encourage students to participate in BIM skill competition and BIM verification, stimulate students' learning enthusiasm and enhance their learning interest <sup>[9]</sup>. BIM courses have the characteristics of intersection, inclusiveness, practicality and so on. Teachers are required to have rich professional knowledge of engineering project management, be proficient in BIM skills, and have good knowledge of BIM application. In addition to mastering the theoretical knowledge of engineering project management, construction project management and BIM application, the operation of BIM 5D should also be well understood <sup>[10]</sup>. BIM 5D can collect project examples of completed schedules.

(2) Set up BIM course teaching and strengthen practical training

Together with hands-on practice, BIM skill training is combined with the existing curriculum system <sup>[11]</sup>. By introducing GMT software into the cognitive practice of architectural engineering to guide students to complete 3D modeling, students' drawing understanding ability has been significantly improved. Graduating students were guided to carry out a graduation design project of engineering management major based on BIM technology, and participated in the National BIM graduation design competition of colleges and universities and achieved good results. The curriculum will be further reformed, focusing on cultivating map recognition ability, construction technology ability, computing ability and project management ability. We complete the architectural course design, installation engineering drawings and construction course design with Revit Architecture software and Revit MEP software <sup>[12]</sup>, as well as the installation of architectural engineering measurement and pricing course engineering Guanglianda BIM calculation software (or Luban BIM calculation software) is used to complete the understanding exercises and knowledge exercises of 3D modeling and engineering calculation in the process of design measurement and pricing, construction organization and schedule management, and engineering projects. Microsoft project combines Guanglianda BIM 3D site layout software (or Luban BE software) to complete the project progress and 3D site layout model <sup>[13]</sup>. To adjust the course design of BIM technology application, students must complete the construction site establishment, calculation, scheduling, three-dimensional layout and construction progress simulation of the frame shear wall model project on time. Based on the application of BIM technology, students can choose the direction of graduation design, and the graduation design link is that students participating in the BIM graduation design should complete the model creation and drawing problems of the project by the team. According to the classification, general pipeline drawing and model information and the engineering quantity was extracted, and the site layout in the project bidding stage and implementation stage was completed respectively <sup>[14]</sup>. The curriculum reform combines the original curriculum with BIM skill training. Students can well complete the creation of BIM model, integrate drawing recognition skills, and combine project implementation.

(3) Improve the multidimensional quality evaluation standard system.

The BIM course covers work objectives and requirements, basic knowledge of project design management, the value of BIM technology in project management, the application of BIM technology in the management of all parties to the project, BIM technology in the construction stage, risk management engineering projects, etc. When designing teaching evaluation methods, basic knowledge and objective evaluation, quality improvement process evaluation, and achievement evaluation can be included <sup>[15]</sup>. Procedural evaluation includes whether the task is received on time before class, the division of task among team members, the contribution of team members in the process of task completion, and whether the task is submitted after class. The students' systematic thinking will be evaluated while discussing topics such as timeliness, the impact of BIM technology on project management, and the importance of risk management in the process of project management. BIM course

teaching can cultivate students' innovative consciousness and professional sensitivity <sup>[16]</sup>. Outcome assessment uses learning reports to assess students' sense of social responsibility and mission, including their understanding of the curriculum and inspiration for personal career and life plans. The assessment process reflects students' understanding of BIM course knowledge, improves the multidimensionality of the evaluation system, and improves the quality of BIM course.

(4) Use BIM technology to optimize the course teaching method

Teaching is the way to realize teaching reform. BIM technology helps to optimize the teaching of “building structure” and promote the consolidation of curriculum certificates <sup>[17]</sup>. College curriculum should focus on improving students' comprehensive professional skills and emphasize on the educational practice of combining theory with practice. The education structure should put students as the main body of education, using actual production projects as the carrier, concentrate on the application of theoretical knowledge to students, make good use of BIM technology, and guide students' practice. In this way, the students' enthusiasm in learning and classroom participation can be stimulated, and their learning can be improved <sup>[18]</sup>. The skill level certificate is the explicit result of the evaluation and learning process. The course training should be connected with the certification requirements, integrate the skill level requirements into the course training, and effectively promote the application of BIM Technology <sup>[13]</sup>. The integration of BIM technology into teaching materials is the basis of educational reform. The integration of BIM technology into building construction teaching materials will help to realize the renewal of teaching materials. Higher vocational architectural structure teaching materials should break the shackles of traditional teaching materials and courses, and systematically reorganize the setting of professional core content and course implementation <sup>[19]</sup>. In the reform of teaching materials, it is necessary to combine the application and support of BIM technology with digital teaching resources. Teachers are the foundation of teaching reform, and BIM technology encourages teachers to adapt to technological advancements. A structured teaching team with teachers' professional ability, practical teaching ability and scientific research ability, “functional integration, reasonable structure, and clear tasks” is the decisive factor for the success of school operation. Professional teachers of architectural courses should not only have rich practical experience and high-level professional teaching ability, but also promote the application of BIM technology in the course. By using BIM technology, teachers can create better information-based education resources, improve teacher-student communication, and guide students to use BIM technology.

## 5. Conclusion

The introduction of BIM technology into the teaching system of engineering construction course and the reform of teaching content can stimulate students' learning interest, improve students' learning enthusiasm and initiative, and effectively improve students' learning ability in combination with practical engineering practice. At the same time, by encouraging students to participate in competitions, it helps to consolidate learning achievements, allow them to feel a sense of achievement, improve practical innovation ability, and nurture structural design talents who can adapt to the development of building industrialization. We could further strengthen the curriculum construction, make up for the deficiencies of efficient reform and practice, and make students better adapt to the development of new technology. BIM course knowledge is complex and the theory is cumbersome, but the overall course structure is orderly and practical. It can help students understand complex architectural construction and improve learning effects. An effective construction of BIM course teaching system can be achieved by making full use of the advantages of BIM course and BIM technology.

## Disclosure statement

The authors declare no conflict of interest.

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