

# Application of BIM Technology in the Teaching of Construction Project Management in Universities

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**Abstract:** This article delves into the current state of construction project management education in universities alongside the emergence and utilization of BIM (Building Information Modeling) technology. It underscores BIM's crucial role in fostering students' hands-on skills and creative thinking. Aiming to enhance educational quality and align with students' professional aspirations, this article outlines the objective of integrating BIM into construction project management instruction. Methodologically, the article identifies gaps in existing teaching practices and content, taking into account student needs and expectations. It then crafts a curriculum that seamlessly blends BIM technology into construction project management coursework. During implementation, emphasis is placed on seamlessly intertwining pre-class preparations, in-class instruction, and post-class guidance to ensure BIM's effective incorporation. The findings reveal that incorporating BIM technology into university-level construction project management instruction notably elevates educational quality, bolsters students' practical abilities and innovative thinking, and establishes a strong foundation for their future careers. This study carries significant theoretical and practical importance, paving the way for advancements and innovations in construction project management education within universities.

## 1. Introduction

In the present educational landscape, the discipline of construction project management in universities confronts unparalleled challenges alongside new opportunities [1]. Traditionally, teaching methods have centered on imparting theoretical knowledge, often detached from real-world practices and technological advancements [2]. Meanwhile, with the swift evolution of information technology, BIM has emerged as a globally adopted tool, offering distinct advantages [3]. BIM not only elevates the efficiency and quality of design work but also ushers in transformative changes for project management [4].

The quality of construction project management education in universities is paramount, as it shapes the future of both students' careers and the broader industry [5]. Nevertheless, a significant number of institutions still adhere to outdated teaching paradigms that neglect honing students' practical and innovative skills [6]. The advent of BIM, however, presents fresh perspectives and approaches for educational institutions.

Integrating BIM into university-level construction project management courses can significantly enhance engagement and effectiveness while fostering students' hands-on expertise and creative thinking [7]. Furthermore, as BIM gains widespread adoption in the construction sector, proficiency in this technology emerges as a valuable asset for students seeking a competitive edge in the job market [8]. Consequently, exploring the integration of BIM in construction project management education carries immense practical value and promising long-term prospects [9]. This article endeavors to delve into effective strategies for incorporating BIM into university curricula, aiming to elevate educational standards and cultivate well-rounded student abilities.

## 2. Theoretical basis

Construction project management theory serves as the fundamental guide for navigating the entirety of a construction project, spanning from its initial planning to its final execution. This

comprehensive framework encompasses diverse elements such as project planning, schedule management, quality control, cost oversight, risk mitigation, and more, all of which are crucial for ensuring the project's seamless progression and attainment of predefined objectives [10]. In university-level courses dedicated to this discipline, students are expected to grasp these fundamental principles and methodologies, equipping them with the flexibility to apply them effectively in future professional scenarios.

BIM technology, emerging as a cutting-edge information tool, has gained widespread adoption within the construction sector. By digitally representing all facets of a building's information, BIM facilitates holistic lifecycle management. Its inherent features of visualization, coordination, simulation, and optimization capabilities enhance both the efficiency and quality of design work, leading to cost reductions, shortened project timelines, and minimized waste and environmental impact. Integrating BIM into the curriculum of construction project management courses at universities offers students a more intuitive understanding of building structures and construction processes, thereby boosting engagement and participation.

### 3. Analysis of the teaching status of construction project management in universities

In the current teaching of construction project management in universities, traditional teaching methods and contents still occupy a dominant position. Teachers traditionally deliver instruction in the classroom, blending educational resources with real-world examples to impart both theoretical knowledge and hands-on experience to learners [11]. Nevertheless, this approach tends to overly prioritize the imparting of theoretical concepts, while neglecting the fostering of students' practical skills and creative thinking. Additionally, the sluggish pace of updating educational materials often results in a mismatch between what is taught and the latest advancements and technological shifts within the construction sector, creating a noticeable gap between educational content and industry demands.

To gain a more nuanced understanding of the current state of construction project management education in universities, this article gathered student feedback and insights through questionnaires, as presented in Table 1.

Table 1 Results of questionnaire survey

Survey content	Result statistics	Student feedback
Satisfaction with current teaching methods	60% dissatisfied	Students think that classroom teaching is too boring and lacks interaction and practical links.
Satisfaction with the current teaching content	55% dissatisfied	Students think that the current teaching content is outdated, failed to update in time, and lacks novelty and foresight.
The demand for the course of construction project management	85% want to learn more practical skills.	Students hope to add case analysis, practical operation and other links in the course to improve their practical operation ability.
Interest and demand for BIM technology	90% are interested and want to learn.	Students generally believe that BIM technology is an important development direction of the future construction industry, and hope to integrate BIM technology-related knowledge into the course.
Suggestions on curriculum improvement	Increase practical links, update teaching content, and introduce BIM technology.	Students suggest to increase the practicality and innovation of the course to meet the needs of industry development and personal career development.

The results show that most students are dissatisfied with the current teaching methods and contents, and think that classroom teaching is too boring and lacks practicality and innovation. At the same time, students generally hope to learn more about emerging technologies such as BIM technology in order to improve their comprehensive ability and competitiveness.

Based on the above analysis, we can see that there are the following problems in the teaching of

construction project management in universities: the teaching method is single and outdated, lacking practicality and innovation; The teaching content is updated slowly, which can not reflect the latest development of the industry in time; Students' demand for emerging technologies such as BIM technology cannot be met. These problems not only affect the teaching quality and effect, but also restrict the cultivation of students' comprehensive ability and career development.

#### **4. Application design of BIM technology in the teaching of construction project management in universities**

Recognizing the challenges in university-level construction project management education, this article suggests integrating BIM technology into the curriculum to enhance teaching quality and foster a more comprehensive set of skills among students. To begin, it's crucial to establish clear goals and guidelines for the use of BIM technology within this educational context.

The primary objectives of incorporating BIM into construction project management teaching are threefold: to provide students with a more intuitive understanding of building structures and construction processes, to equip them with the necessary skills and techniques for applying BIM in real-world projects, and to bolster their hands-on capabilities and innovative thinking. Furthermore, the integration of BIM is expected to nurture non-technical proficiencies such as team collaboration and effective communication, which are equally essential in the construction industry. In terms of teaching principles, this article will follow the principles of student-centered, practice-oriented, and ability training as the core. Specifically, teaching contents and methods will be designed according to students' actual needs and interests, and students' practical operation and experience will be emphasized, and the cultivation and promotion of students' comprehensive ability will be emphasized. In terms of teaching content and methods, the course content of construction project management with BIM technology will be designed. The theoretical teaching part will focus on the basic concept and principle of BIM technology and its application methods and cases in construction project management; The practical teaching part will organize students to do practical exercises such as BIM modeling and construction simulation; The case analysis part will select typical construction project cases to guide students to use BIM technology to analyze and solve problems.

In order to support the teaching of BIM technology, it is necessary to equip corresponding teaching resources and platforms. In terms of software and hardware resources, it provides high-performance computer equipment, professional BIM software and rich library of building materials and components. On the aspect of online teaching platform, students can learn, communicate and practice online by using the existing online education platform or developing a special BIM technology teaching platform. With the support of these teaching resources and platforms, the application of BIM technology in the teaching of construction project management can be carried out more effectively.

#### **5. Application and practice of BIM technology in the teaching of construction project management in universities**

During the implementation of teaching, the integration of BIM technology into the construction project management curriculum has been meticulously planned and executed. In the preparatory stage prior to classes, educators collaborate to develop a BIM model tailored to the course material, guaranteeing its precise representation of core concepts and challenging aspects. Additionally, instructors craft comprehensive teaching strategies and lesson outlines based on students' preexisting knowledge and areas of interest, ensuring that the BIM technology introduction aligns seamlessly with their educational requirements.

In the classroom teaching stage, teachers use BIM software to display buildings in three dimensions and simulate the construction process, so as to guide students to deeply understand all aspects of construction project management through intuitive observation and analysis. In addition to theoretical teaching, teachers will also organize students to carry out BIM practical operations,

such as modeling, collision detection and construction optimization, so that students can master the application methods and skills of BIM technology in practice.

In the after-class tutoring stage, teachers provide online teaching resources and tutoring materials to help students consolidate what they have learned in class and encourage students to study independently and expand their practice after class. At the same time, teachers regularly organize students to exchange and discuss the application of BIM technology, share their learning experiences and achievements, and create a positive learning atmosphere.

In order to evaluate the effect of BIM technology in the teaching of construction project management, this article adopts various evaluation methods, and the evaluation results are shown in Table 2 and Table 3.

Table 2 Comparison of course performance and practical ability of construction project management

Evaluation index	Average score of traditional teaching classes (Out of 100)	Average score of classes introducing BIM technology (Out of 100)
Course theoretical achievement	75	85
Course practice achievement	70	88
Comprehensive practical ability	65 (Teacher evaluation)	82 (Teacher evaluation)

The table shows the comparison between the traditional teaching class and the class with BIM technology in the course performance and practical ability of construction project management. The classes that introduced BIM technology showed significant advantages in all evaluation indexes.

Table 3 Students' feedback on the application of BIM technology

Feedback content	Proportion of students who agree
BIM technology makes the course content more lively and interesting.	85%
BIM technology has improved my interest in learning.	90%
BIM technology has improved my class participation.	80%
BIM technology plays an important role in my future career development.	95%

This table presents student feedback regarding the incorporation of BIM technology in the construction project management course. A majority of students concur that the use of BIM technology enhances the course's engagement and intrigue, thereby elevating their learning motivation and involvement. Furthermore, they perceive BIM as a pivotal tool for advancing their future professional prospects.

A comparative experiment reveals that the performance and practical skills exhibited by students in the BIM-integrated class surpass those in the traditional teaching environment. Echoing the initial feedback, students report that BIM technology injects vitality and interest into the coursework, fostering a deeper engagement with the material. Additionally, there is widespread agreement among students that BIM plays a crucial role in furthering their career aspirations.

## 6. Conclusions

After conducting a comprehensive series of research and practical applications, this article arrives at several key conclusions. The integration of BIM technology into university-level construction project management education holds significant practical value and promising long-term prospects. By embracing BIM technology, educators can elevate both the quality and impact of their courses while fostering students' hands-on skills and innovative thinking. This, in turn, lays a strong groundwork for students' professional development.

Nevertheless, our study encounters certain constraints. Primarily, due to time and resource constraints, our exploration of BIM technology's practical applications and research could only be conducted within a confined scope. Moreover, varying teaching environments and resources across universities necessitate a tailored approach to BIM technology implementation, which may require

further adaptation and refinement.

Looking ahead, this article anticipates considerable growth potential for BIM technology in construction project management education. Future research efforts could concentrate on several areas: enhancing BIM technology's educational resources and platforms to streamline teaching processes; developing more tailored BIM application strategies for diverse student populations; and strengthening the interoperability between BIM technology and other related course offerings to create a more cohesive and comprehensive educational experience. With continued research and expanded practical applications, BIM technology is poised to play an increasingly pivotal role in shaping the future of construction project management education.

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