ISSN 2663-8169 Vol. 7, Issue 7: 27-32, DOI: 10.25236/IJNDE.2025.070705

Discussion on the Teaching of Engineering Costing in the Context of BIM Technology

Feng Li[1]

[1]*School of Water Conservancy, North China University of Water Resources and Electric Power, Zhengzhou, Henan, 450046, China*

Abstract: *With the rapid development of information technology, BIM technology has been widely used in the field of engineering construction, which has brought revolutionary changes to engineering cost management. This paper discusses the challenges and opportunities facing the teaching of engineering costing profession in the background of BIM technology. By analysing the key technology and application value of BIM technology in engineering cost management, combined with the current status and challenges of engineering cost professional teaching, it puts forward a series of targeted and easy-to-implement teaching strategies and methods, aiming at optimizing the teaching process and actively exploring the effective integration and innovative application path of BIM technology in the teaching of engineering cost professional courses in colleges and universities. On this basis, the article further suggests that the practical operation ability of students should be enhanced by simulating actual engineering projects, and at the same time, the teaching content should be updated regularly to keep pace with the development of BIM technology by combining with the dynamics of the industry.*

Keywords: *BIM Technology; Engineering Cost; Professional Teaching*

1. Introduction

With the rapid advancement of information technology, cutting-edge digital tools such as BIM (Building Information Modeling) are transforming every aspect of the construction industry with unprecedented depth and breadth. BIM technology, with its powerful 3D visualization, information integration, collaborative management, and full lifecycle coverage capabilities, has evolved from a simple design tool into a core technological platform spanning project planning, design, construction, operation, and even demolition[1]. In fields such as water conservancy engineering, building construction, and municipal infrastructure, the application of BIM technology has become increasingly mature and widespread, significantly improving project design accuracy, construction efficiency, cost control levels, and asset management capabilities. This profound industry transformation inevitably impacts the closely related field of engineering cost management. As a core component of project investment control, engineering cost management is now facing revolutionary challenges and opportunities brought about by BIM technology. The rich, structured, and computable information contained in BIM models provides robust technical support for automated quantity takeoff, real-time cost simulation, rapid analysis of change impacts, and dynamic cost control throughout the entire process, enabling cost management to transition from a relatively static and lagging approach to a dynamic, refined, and intelligent one [2].

Against this backdrop, higher education institutions, which serve as the cradle for cultivating future engineering cost management professionals, are facing unprecedented pressure to transform their engineering cost management curricula. Traditional course structures, teaching content, teaching methods, and practical training components are increasingly at odds with the industry's growing demand for composite talent proficient in BIM technology and capable of comprehensive cost control throughout the project lifecycle. On one hand, the deep integration of BIM technology into cost management processes requires practitioners not only to master traditional cost management theories, quota standards, and contract management but also to proficiently master new skills such as BIM modeling, information extraction, model application, and collaborative platform operations, while deeply understanding the logic of cost data flow and value analysis in a BIM environment. On the other hand, current cost management programs often suffer from issues such as an overemphasis on theory at the expense of practice, outdated curriculum content that lags behind technological advancements, limited teaching methods, and insufficient interdisciplinary integration. In many institutions'

ISSN 2663-8169 Vol. 7, Issue 7: 27-32, DOI: 10.25236/IJNDE.2025.070705

curriculum frameworks, BIM-related content is either absent or merely offered as isolated elective courses or software operation courses, failing to integrate it organically into the core courses of cost engineering programs. This results in students struggling to develop a systematic understanding and practical skills that deeply integrate BIM technology with cost engineering knowledge. This disconnect not only affects the quality of talent cultivation and employment competitiveness but also constrains the overall technical level of the engineering cost estimation industry and its ability to adapt to the pace of digital transformation.

Therefore, in the context of the rapid development of BIM technology, it is of great practical significance and strategic value to explore how engineering cost estimation education can proactively seek change and actively innovate. This not only concerns the ability to cultivate high-quality cost estimation talent who can meet the cutting-edge needs of the industry, possess core competitiveness, and handle future complex projects, but also concerns the vitality and sustainable development of the engineering cost estimation major within higher education. Studying the key application points and core value of BIM technology in engineering cost management is the foundation for reconstructing and optimizing the professional curriculum system.

This paper aims to systematically analyze the importance of BIM technology to the engineering cost management major and the challenges it poses to teaching in this field. Based on an in-depth analysis of the current teaching situation, it proposes a series of practical and forward-looking teaching reform strategies. These strategies will focus on how to deeply and organically integrate BIM technology into existing core courses, develop innovative teaching methods, and build a BIM-based practical teaching platform. Through highly simulated training of actual engineering projects, students' practical operational capabilities and ability to solve complex engineering problems will be significantly enhanced. Additionally, emphasis will be placed on establishing a dynamic teaching content update mechanism to closely track changes in BIM technology standards, industry application cases, and policy directions, ensuring the cutting-edge and timely nature of teaching content. The ultimate goal is to explore and implement an effective teaching pathway for engineering cost estimation that integrates and innovatively applies BIM technology, optimize the overall teaching process, comprehensively enhance teaching quality, and cultivate outstanding professional talent capable of leading and adapting to the BIM-era transformation in cost management, thereby effectively driving the transformation, upgrading, and sustainable healthy development of the engineering cost estimation industry.

2. The Importance of BIM Technology for the Engineering Costing Profession

2.1 Optimising cost control

BIM technology can accurately display detailed information about a building's geometric dimensions, spatial layout, and component attributes by using 3D models for quantity calculations. For example, by creating detailed virtual models, BIM technology can accurately capture every detail of a construction project, including the structure, materials, and workmanship, thus enabling accurate prediction and control of project cost[3]. Compared with the traditional manual calculation or two-dimensional drawing calculation, the application of BIM technology significantly reduces the calculation errors and repeated calculation workload caused by human errors, differences in the interpretation of drawings, etc. BIM technology also integrates multidimensional project information, including schedule, quality, and safety. By comparing and analyzing actual cost data against budgeted costs, it promptly identifies cost deviations. Utilizing an alert mechanism, it rapidly notifies cost estimators to make adjustments. This ensures the efficiency and timeliness of cost control and effectively prevents cost overruns. Moreover, this approach not only facilitates the early identification of potential cost risks but also enables the optimization of design schemes and the reduction of unnecessary costs through the comprehensive analysis of project investment, schedule, quality, and other key factors. At the end of the project, the BIM model can also provide detailed data support for the later operation and maintenance, realising effective asset management, further extending the service life of the building and thus improving the economic efficiency of the project.

2.2 Realise cost control and collaboration throughout the entire project process

BIM technology not only runs through the whole process of planning, design, construction and operation of engineering and construction projects, but also integrates and real-time monitors cost

ISSN 2663-8169 Vol. 7, Issue 7: 27-32, DOI: 10.25236/IJNDE.2025.070705

information through 5D simulation, so as to predict and control costs in the design stage of the project, optimise the allocation of resources and manage the progress in the construction stage, and realise efficient maintenance management in the operation stage, thus comprehensively covering the process of engineering cost management. In addition, in the process of project construction, design changes, engineering negotiations and other conditions occur frequently, but with the BIM model's instant updating and collaborative operation capabilities, cost staff can quickly grasp the project progress and cost profile, thus providing solid data support for project decision-making. Once a component in the model is changed, the relevant quantity information will be automatically updated to ensure the consistency and timeliness of the data, effectively preventing the cost of the project caused by data lag. Once there is a change in a component in the model, the relevant quantity information will be updated automatically, ensuring the consistency and timeliness of the data, and effectively preventing cost calculation errors caused by data lag. Through the BIM technology, the engineering costing profession can also realise information sharing and collaborative work with other professions to improve work efficiency and quality. It greatly accelerates the informatisation process of the engineering costing profession.

3. Deficiencies in the current teaching of engineering costing in the application of BIM technology

3.1 Inadequate curriculum

The current curriculum structure for construction cost estimation programs exhibits significant structural deficiencies in integrating BIM technology, primarily manifested in the lack of systematic course design and insufficient depth of content. While some universities have introduced BIM-related courses, these often occupy a marginal position within the overall curriculum framework, typically existing as isolated elective courses, and lack overarching design and systematic planning spanning the entire teaching cycle. This fragmented course structure results in disjointed teaching content, making it difficult to form a coherent knowledge chain. Students are unable to effectively build a comprehensive knowledge framework that encompasses BIM core concepts, technical standards, workflows, and their deep application throughout the entire lifecycle of engineering cost estimation.

More critically, existing course content is generally superficial, overly focused on basic operational skills training for a single software program, while severely neglecting how BIM technology can deeply empower key aspects of core cost estimation business operations. These include model-based automated precise quantity calculation, real-time analysis of the impact of design changes on costs, cost simulation in multi-option comparison and optimization, and BIM-based collaborative work and information management processes. This disconnect between course content and the core knowledge system of the profession has reduced BIM technology to an isolated technical tool rather than an organic component deeply integrated into the cost estimation professional knowledge structure.

3.2 Single method of teaching

In the current education system, the diversity and innovation of teaching methods are crucial to improve the quality of teaching.Most of the BIM related courses follow the traditional teaching mode, still mainly based on classroom lectures.With the rapid development of the economy, the engineering projects have become more and more complex, and it is difficult to present the decision-making, implementation and management process of the project intuitively and clearly with the traditional teaching mode.The reason for this is that many colleges and universities in China lack the corresponding hardware and software conditions in the engineering costing profession. The reason for this is that many universities in China lack corresponding hardware and software conditions in engineering costing, especially in the practical training equipment for BIM technology courses, which is significantly insufficient. At the same time, the BIM software for teaching is still to be strengthened in terms of function, which leads to the fact that students need to re-learn and adapt to the software used by enterprises when they enter the enterprises after graduation, which not only weakens the competitiveness of the students' employment, but also reduces the efficiency of work. Under this teaching mode, there is a big gap between students' theoretical knowledge and practical operation ability.

3.3 Lagging faculty development

The lag in teacher training is one of the key factors hindering the effective integration of BIM

ISSN 2663-8169 Vol. 7, Issue 7: 27-32, DOI: 10.25236/IJNDE.2025.070705

technology into the field of engineering cost estimation. This lag is primarily manifested in the slow pace of updating the knowledge structure of the teaching staff, which lags far behind the rapid iteration of BIM technology and the deepening of its application in the industry. Many teachers who have long been engaged in traditional engineering cost teaching developed their professional knowledge systems before the widespread adoption of BIM technology. They lack systematic understanding and in-depth comprehension of BIM technical standards, workflows, and its deep application throughout the entire cost management process. More importantly, the vast majority of teachers lack practical experience in applying BIM technology for full-process cost management in real engineering projects. This makes it difficult for them to go beyond superficial explanations of software operations in their teaching, preventing them from effectively integrating BIM technology with the core knowledge of the cost estimation profession. They also struggle to analyze the actual value and methodologies of BIM in addressing complex cost estimation issues through vivid engineering case studies.

Meanwhile, universities generally lack systematic and sustained mechanisms for cultivating BIM faculty. Professional training opportunities for teachers are not only scarce in number but also often focus on basic software operations or isolated technical points, lacking in-depth customized training tailored to the characteristics of the cost management profession.

4. Improvement Strategies for Teaching Engineering Costing in the Context of BIM Technology

4.1 Optimising the curriculum

The curriculum system is an important basis for education and teaching, and it is the key to cultivate talents. At present, the curriculum of engineering costing in colleges and universities is set according to their professional 'educational standards and training programmes and syllabus of main courses', which contains basic courses, professional basic courses, professional courses, core competence courses and so on in the course structure[4]. The existing curriculum system should be optimized through the incorporation of BIM technology-focused courses, exemplified by Introduction to BIM, BIM Modeling, and BIM Cost Management. Through the curriculum reform, we can lay a solid foundation concept for students to manage the whole process, elements and life cycle of engineering cost [4]. At the same time, teachers can use BIM to establish an organic link with the courses related to water conservancy project costing, build a practical teaching system of BIM technology that covers key links such as course experiments, course design, graduation design, etc., to ensure the systematic nature of the curriculum system, and then achieve the effective cultivation of skillful talents, and help the teaching reform of engineering costing under the background of the new engineering discipline.

4.2 Innovative teaching methods

Combined with the teaching characteristics of the construction engineering costing professional, in order to continue to promote the development of professional teaching, we should take BIM technology as the basis, and actively create a new teaching method, so as to better promote the development of course teaching. For instance, teaching methodologies like the 'Group Eight-step Teaching Method' can be implemented. In the 'group eight-step teaching method', the teacher should carry out the fragmented task design of the entire training project case, play the main role of the students, the specific teaching process shown in Figure 1 [5]. Using the 'group eight-step teaching method' mode of teaching, this mode makes full use of the content of the lecture, and effectively improves the classroom teaching effect[6]. The school is equipped with BIM software and related practical training equipment, regularly organizes students to carry out internship training, introduces the real cases of enterprises in practical training, understands the mode of operation of the enterprise, realizes remote collaboration through the digital platform, simulates the actual workflow, and lets the students participate in the real engineering projects, so that they can personally participate in the application of BIM technology in the engineering projects, so as to achieve the deep integration and enhancement of theoretical knowledge and practical skills. Schools and teachers should actively organise students to participate in BIM technology competitions and innovation and entrepreneurship activities, which will help students consolidate and deepen their theoretical knowledge, enhance their practical ability and innovative thinking, and achieve the perfect combination of theory and practice.

ISSN 2663-8169 Vol. 7, Issue 7: 27-32, DOI: 10.25236/IJNDE.2025.070705

Figure 1: Specific steps of the group's eight-step teaching method

4.3 Strengthening the faculty

In order to enhance teachers' mastery and application of BIM technology, colleges and universities and higher vocational institutions should strengthen teacher training and organise teachers to participate in professional training and academic exchange activities on BIM technology, and the content of their training courses should not only contain the core elements of BIM technology, but also incorporate the latest trends of the industry's development as well as case studies, so as to ensure that the educators are able to accurately grasp the dynamics of the industry's development, and to pre-identify and respond to the problems and challenges that may be encountered in the teaching process. Colleges and universities should also pay attention to the professional development of teachers, set up targeted teacher training programmes, open up promotion channels for teachers, set up academic exchange platforms, and motivate teachers to devote themselves to scientific research and technological innovation. In addition, the introduction of professionals with practical experience in BIM technology to help students more deeply understand the specific application of BIM technology in engineering practice, enriching the teaching staff. Through the above measures, we aim to cultivate a faculty team proficient in both theoretical knowledge and practical skills, thereby providing a solid foundation for nurturing BIM technology talents in China.

5. Conclusion

BIM technology represents the future of engineering design, which digitally integrates information from the entire life cycle of a construction project and allows project participants to work collaboratively on a unified model.The development of BIM technology has brought new opportunities and challenges to the teaching of engineering costing. Taking the GLD project as an example, BIM technology provides comprehensive data support for engineering cost management by creating a digital model and integrating building information, which improves efficiency and accuracy. In the teaching of engineering costing, colleges and universities should actively optimise the curriculum system, innovate teaching methods, and strengthen the construction of teaching staff, in order to cultivate high-quality engineering costing professionals to meet the development needs of the industry. At the same time, colleges and universities should strengthen cooperation with enterprises, further promote the in-depth integration of production, learning and research through the construction of school-enterprise cooperation bridges, and provide students with rich practice opportunities, so as to deliver more high-quality engineering cost professionals to society. On this basis, colleges and universities should also pay close attention to industry dynamics, continue to improve the teaching content, to ensure that it keeps up with the latest development trend of BIM technology, and jointly promote the application and development of BIM technology in the field of engineering costing. This not only promotes the long-term development of schools, but also meets the needs of society for high-quality talents.

References

[1] Jin Jing.Discussion on the teaching reform of engineering costing speciality under the background of BIM technology[N]. Shanxi Science and Technology News, 208-26(A10).
[2] Zhou Ting, Chen Zibo. Research on the teaching mode of engineering costing based on the

ISSN 2663-8169 Vol. 7, Issue 7: 27-32, DOI: 10.25236/IJNDE.2025.070705

background of BIM technology[J]. Modern (Zhongdian),,(03):256.DOI:10.16141/j.cnki.1671-8089.2019.03.228.

[3] Gu Zhiwei,Li Shushan,Li Hongmei.Research on the teaching reform of engineering costing speciality in the background of BIM technology[J]. Exploration(in),2018,(06):26-27.

[4] Peng Yan.Research and analysis on teaching reform of engineering costing profession under the background of BIM technology[C]//Construction Science and Technology and Management Organising Committee.Proceedings of the August 2017 Academic Exchange Conference on Construction Science and Technology and Management. Anhui Institute of Industrial Economics and Vocational Technology; 2017:2.

[5] Tang Yiming. Research on the teaching mode of engineering costing profession based on the background of BIM technology[J]. Science and Technology Wind,2019,(10):41.DOI:10.19392/j.cnki.1671-7341.201910034.

[6] Yuan Min. Research on the teaching mode of engineering costing speciality based on the background of BIM technology[J]. Journal of Heihe College,2017,8(04):123-124.