Research on the teaching status of BIM technology in civil engineering specialty in Higher vocational colleges

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Abstract. The rapid development of BIM technology (building information modeling) has made an important contribution to the construction engineering industry, and also brought about subversive changes in the education and teaching of civil engineering professionals in higher vocational colleges, and also put forward new challenges. This paper analyzes the current situation of BIM technology in the teaching of civil construction majors in higher vocational colleges in our country, and studies the existing problems of BIM technology in the training of higher vocational talents. It is proposed that teachers of civil engineering in higher vocational colleges should update their ideas, improve the application level of BIM technology, and strengthen the deep integration of BIM technology and professional courses.

Keywords: BIM technology; Higher vocational college; Major in civil engineering; Teaching.

1 Introduction

BIM (Building Information Modelin, building information model), refers to the construction of the project or a certain period of time, the whole life period application information model for the system design, collaborative, virtual construction, construction cost control and post operation management means of informatization[1]. The powerful information storage and visualization technology of BIM technology can improve the fine management level of the whole process of construction engineering projects and increase project benefits. BIM technology education and teaching research has become a focus of educators in the construction industry.

In recent years, with the continuous development of cloud computing, the Internet of things, 5G and other new technologies, construction information in our country has developed rapidly, the construction industry in BIM, big data, intelligence and other information technology integration application ability has increased significantly[2]. At the same time, the rapid development of informatization in the construction industry is in urgent need of colleges and universities, especially higher vocational colleges, to keep up with the development of the industry and cultivate informatization construction talents who can solve practical engineering problems.

Based on surveys and interviews with teachers and students of higher vocational colleges equipped with civil construction majors, by using literature study, questionnaire survey and

ITEI 2022, December 23-25, Harbin, People's Republic of China

DOI 10.4108/eai.23-12-2022.2329147

mathematical statistics methods, the application of BIM technology in higher vocational civil construction professional education in our country is collected, and it analyzes the current situation of BIM education in our country and summarizes the shortcomings. Thus to perfect the personnel training of higher vocational education in the information age.

2 Research object

Questionnaires were distributed to higher vocational colleges with civil engineering majors. The research objects are divided into two parts. One is junior college students in higher vocational colleges who are in the stage of internship in enterprises. The main research content is the application of BIM technology in the parties involved in construction engineering projects. The other part is for teachers and students of civil engineering majors in higher vocational colleges. The content of the questionnaire involves the teachers and students' familiarity with BIM technology, the setting of BIM-related courses in our school, the distribution of disciplines, the integration of courses, the factors affecting future development, the teaching effect, the existing problems in teaching and so on.

A total of 700 questionnaires were sent out and 673 were received, among which 670 were valid with effective recovery of 99%. Among the 670 students, 367 were male, accounting for 54.6%, while 303 were female, accounting for 45.4%, indicating a balanced ratio of men to women. In terms of grade attributes, most of the interviewees are juniors and sophomores, accounting for 38.6% and 40.1% respectively, while the number of other grades is small.

3 Research findings

3.1 The development of BIM technology in civil engineering of higher vocational colleges

By searching the journal papers on BIM education on CNKI and Baidu, the papers whose authors are teachers in higher vocational colleges are selected, and then the search results are further conditionally screened to ensure that the selected papers can effectively reflect the real application status of BIM technology in Chinese higher vocational education[3]. As shown in Figure 1, according to the distribution of paper publication, it can be seen that higher vocational education of BIM technology began in 2006, lagging behind the application of BIM technology in the construction industry for about three years. It can also be seen from the change of the number of papers published that BIM technology is becoming more and more popular in higher vocational civil construction education.

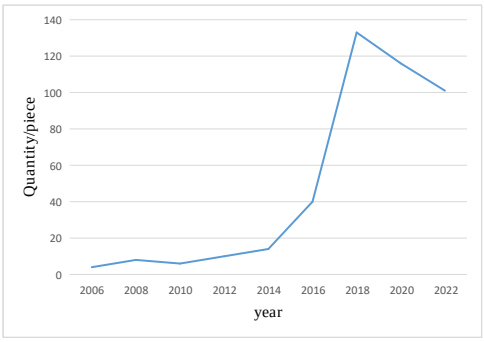

FIG. 1 Annual chart of BIM paper quantity distribution in Higher vocational colleges

3.2 Subject distribution of BIM technology in higher vocational colleges

According to the survey results, BIM technology has been integrated into many disciplines in higher vocational colleges to varying degrees. The statistical results show that BIM technology is mainly applied in engineering management (49.2%), architecture (16%) and civil engineering (22.8%), while bridge, track and road engineering account for a relatively small proportion, only 4.9% in total. BIM education was followed by construction environment and energy application engineering (4%), and a small number of hydraulic engineering (1.2%), electrical engineering (0.3%), municipal engineering (0.8%), and geotechnical engineering (0.8%).Figure 2 shows the subject distribution of BIM education.

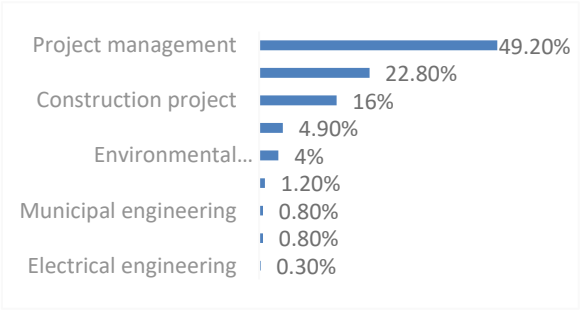

FIG. 2 Subject distribution of BIM integrated into teaching

3.3 Problems in the teaching of BIM related courses

As for the main problems existing in the teaching of BIM related courses, the most prominent problem is that the professional ability of teachers in BIM technology needs to be improved (27.45%), followed by the lack of systematic application of BIM technology in professional courses (15.13%). Other examples include lack of BIM teaching materials deeply integrated with professional courses (13.78%), lack of course practice or insufficient time for practice (9.98%), low configuration or serious shortage of computer facilities (14.02%), incomplete or systematic setting of BIM basic courses and BIM core courses (8.83%), and only BIM courses Only used as a modeling tool, BIM has low utilization rate of integrated function development (10.81%).

3.4 The influence of the application of BIM technology on the learning effect of professional courses

According to the survey, in the study of professional courses, when BIM technology is combined with task-driven teaching method to complete learning tasks, students' learning interest and efficiency are improved in 43.1%, practical skills are improved in 22.3%, team spirit is improved in 18.6%, and critical thinking ability is cultivated in 16%. Figure 4. The influence of BIM technology on learning effect.

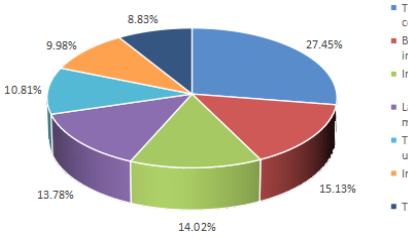

FIG. 3 Problems in BIM teaching

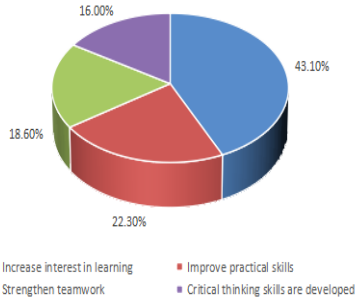

FIG. 4 Influence of BIM technology on learning effect

3.5 The impact of BIM5D technology on students' core skills and job competency

BIM5D is a BIM-based whole-process project management tool. With BIM model as the carrier, BIM5D can realize the correlation of business information such as schedule, budget, materials, contract, quality and safety, and help the project personnel to make effective decisions and fine management, so as to reduce project changes, shorten project duration, control project cost and improve construction quality[4]. Students generally understand that BIM5D technology is actively promoted in the engineering industry. Construction enterprises, especially small and medium-sized enterprises private construction enterprises, are in urgent need of talents who know BIM5D. Therefore, students hope to master the BIM5D technology at school. It can not only realize the seamless connection with the vocational ability required by the industry enterprises, but also greatly increase the vocational competitiveness.

3.6 What students think will affect their future development

In the investigation of factors affecting future development, the data of professional knowledge, practical ability, application ability of BIM technology, professional ethics, teamwork ability, social responsibility, honesty and trustworthiness, critical thinking, and innovative spirit are analyzed according to Likert scale. Data were collected for "strongly agree", "agree", "not necessarily", "disagree" and "strongly disagree" answers, which were recorded as 1, 2, 3, 4 and 5 points respectively. All the scores of each respondent were added up, and the mean value was calculated. Table 1 is the mean value of factors affecting students' future development.

Table 1. Average value of factors affecting students' future development

variable	total number	minimum	maximum	average
professional knowledge	670	1	4	1.61
practical ability	670	1	5	1.32
BIM technology application ability	670	1	4	1.32
teamwork ability	670	1	4	1.52
professional ethics	670	1	5	1.43
sense of social responsibility	670	1	5	1.57
honesty and trustworthiness	670	1	4	1.48
critical thinking	670	1	5	1.54
spirit of innovation	670	1	5	1.45

It can be seen from Table 1 that the mean values of all factors are less than 2, indicating that respondents believe these factors will have a great impact on the future development. Among them, the average value of practical application ability and information technology application ability is the lowest, both being 1.32, which means that respondents think their influence on the future is the greatest. It can be seen that students attach more importance to practical application ability and information technology application ability.

Students believe that in the short term, the professional knowledge, practical ability and application ability of information technology learned in school will have a great influence on job selection and work effect at the initial stage of employment. In the long run, professional ethics, teamwork, social responsibility, honesty and trustworthiness, critical thinking, innovation and other moral qualities and abilities can play a more important role in a career[5].

3.7 The proposed solution

In view of the existing problems in BIM teaching, 25.23% of the proposed suggestions believe that increasing or integrating the certification system related to BIM courses will make BIM education influential; By holding various competitions to provide more practical opportunities to improve BIM skills accounted for (17.89%); Those who established BIM training center to meet practical needs accounted for (16.33%). In addition, the need to increase capital input through school-enterprise cooperation accounted for 12.30%. In view of the shortage of teaching materials, teachers could be encouraged to compile school-based teaching materials according to their professional needs (11.89%), and sharing educational materials with other schools could provide more choices (6.53%). Students' application skills can be improved by hiring enterprise experts to hold BIM lectures (9.83%). Figure 5 shows the proposed solution.

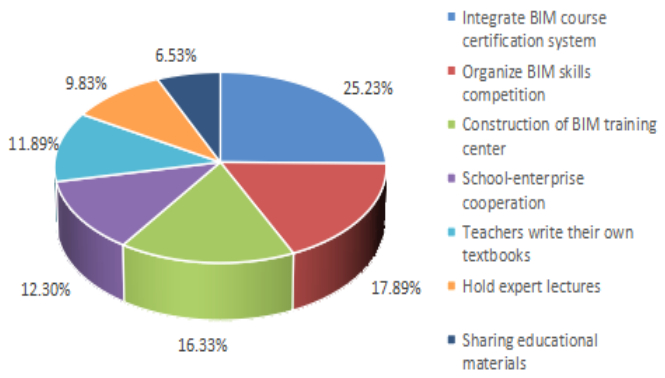

Fig.5 Suggested Solutions

4 Analysis and discussion

4.1 The degree of integration and quality of courses related to BIM technology need to be improved

As BIM technology is actively promoted by the state and rapidly popularized by enterprises[6], students hold a very positive attitude towards the integration of BIM technology and professional course content, but believe that the degree and quality of integration need to be improved. In the interview with students, it is found that in the learning process of professional courses, professional knowledge and BIM technology-related content are often disjointed.

4.2 The function of BIM technology is too simple

BIM technology is a whole-process management tool for engineering projects. It is a multi-functional platform with design, construction quality management, schedule management, cost management, contract management and the Internet of Things[7]. About BIM courses in higher vocational colleges, some only offer basic BIM courses, which mainly teach the content of modeling, which is only the most elementary function of BIM technology. There are still many unutilized potentials of this technology in 3D visualization, project design optimization and integration with other technologies[8].

4.3 The application level of BIM technology in teachers needs to be improved

Due to the influence of teachers' own knowledge reserve and practical experience, especially when professional teachers have little practical experience or no practical engineering experience, it is difficult to apply BIM technology to professional teaching.

Professional teachers can participate in practical engineering projects, build school-enterprise technology application exchange platform through school-enterprise cooperation, or improve their professional and teaching ability in aspects of integrated teaching ability of science and

practice, BIM technology application ability and so on through various training[9]. In this way, the latest BIM technology can be imparted to students in teaching.

5 Conclusion

Based on the literature analysis and the statistical analysis, induction and summary of the questionnaire, the following conclusions are formed: (1) BIM technology has become an important part of the teaching of civil engineering majors in higher vocational colleges. It is one of the ways to improve the teaching ability of BIM technology to improve and expand professional teachers' knowledge of computer technology and information technology. (2) To improve the teaching effect of BIM technology, we should pay attention to the construction of teaching content, deeply integrate traditional professional courses with the application of BIM technology, and improve the proportion and efficiency of BIM technology in the teaching of civil engineering majors. (3) The BIM education in our country is at the stage of focusing on the application of BIM professional skills and software operation. The education concept needs to be updated, and BIM technology can not be regarded as a modeling tool talent in an isolated way.

In the era of rapid development of information technology, our knowledge, experience and advantages have been wiped out under the impact of informatization[10]. With the development of BIM technology, teachers need to constantly learn new technologies and methods, establish and update a richer resource platform, and cultivate a full range of technical talents for the society.

Acknowledgment. Scientific Research Fund project of Yunnan Education Department in 2022(2022J1362).

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