Analysis of the Use of BIM Technology in the Training of Professional Degree Master Talents

Bailing Zhou[1], Dong Wang[2,*], Tianhua Jiang[3], Hongbing Zhu[4]

[1] *Wuhan University of Science and Technology*
[2] *Wuhan University of Science and Technology*
[3] *Wuhan University of Science and Technology*
[4] *Wuhan University of Science and Technology*
[*]*Corresponding author. Email: dongwang@gmail.com*

ABSTRACT
BIM technology has the advantages of synergy, visualization, simulation, optimization, cost saving, and common construction and sharing. According to the background of the 14th Five-Year Plan of the construction industry, and also taking into account the specific situation of local universities, this study explores the application of BIM technology in the talent training of masters in civil engineering, water conservancy and architecture.

Keywords: *Building Information Modelling, Professional Degrees; Innovative Talents.*

1. INTRODUCTION

Professional degree graduate students in Civil and Hydraulic and architecture should be oriented to applied practice, and cultivate high-level innovative talents with obvious professional backgrounds who have received high-level professional training in professional technology. At present, the training of relevant talents in China is more gathered in the combination of theoretical teaching sessions and knowledge level. Little consideration is given to the ability of graduate students to master the application of different disciplines in hands-on sessions and in the process of solving real engineering problems. We have little regard for the ability of students from different disciplines to use their respective professional applications to solve problems together. This self-imposed isolation exists to a greater or lesser extent between different disciplines within civil engineering, as well as between universities and society.

As a pillar industry of the national economy, the construction industry has a high degree of industrial relevance and a large employment capacity. It is the basic industry on which many industries depend, and at the same time has a close relationship with the development of the whole national economy and the improvement of people's lives. Since 2009, the ratio of the value added of the construction industry to GDP has always remained above 6.5%. With the surge of mobile Internet, the platform economy, the rise of the sharing economy, cross-border and integration has become a major trend. Emerging business models continue to emerge. Building Information Modelling (BIM) is the establishment of a building model based on the information data of a building project, and it simulates the real information of a building through digital information. BIM is at the same time a digital approach applied to design, construction, and management. This approach supports an integrated management environment for civil construction projects, which can lead to significant efficiency gains and substantial risk reduction throughout the process.

Accelerating the application of new technologies such as Building Information Model (BIM) and network-based collaborative work in engineering" is the overall goal of China's construction industry information construction. During the "14th Five-Year Plan" period, the "construction industry" will be combined with more elements and integrated into the wave of industry chain extension and cross-border integration. The main direction includes the construction industry + Internet + digital. In the context of the national vigorous promotion of new infrastructure, the construction industry must actively explore the new mode of management and production under the situation of "Internet+". We can only innovate business models, enhance core competitiveness and achieve leapfrog development by deeply studying the innovative

application of big data, artificial intelligence, BIM, Internet of Things and other technologies.

In this context, we explore ways to train talents who can promote the application of BIM, collaborative design, virtual reality, 4D project management and other technologies in survey and design, construction and engineering project management. In this way, we can cultivate high-level innovative talents to improve the traditional production and management mode for the construction field. Ultimately, the goal of improving the production efficiency and management level of enterprises will be achieved.

This exploration is of great significance to the further optimization of the teaching system and teaching mode of the professional master's degree in Civil and Hydraulic and architecture, and also provides a reference value for modern higher engineering education.

2. REVIEW OF THE CURRENT STATUS OF DOMESTIC AND INTERNATIONAL RESEARCH

LI Jiancheng elaborates that the construction industry is entering into BIM age, and analyses the positive impact of the application of BIM on architects and architectural design, and then discusses the countermeasures of architectural education in this situation. That is to cultivate the students' quality of BIM to face the upcoming BIM application climax.[1]

Marc Aurel Schnabel noted that the consequences of digitally driven processes and thinking on architectural education are profound allowing for novel interactions to arise. Social-intelligence and-engagement that is fostered by social networks feed seamlessly into the learning and knowledge building akin to the working environment of BIM. [2]

LI Fei puts forward the idea of strengthening green development education and teaching, and then introduces the research on green architecture education and teaching with the cooperation of undergraduate and undergraduate in accordance with the author's practice in training graduate students majoring in architecture and civil engineering. Practice, from participating in engineering practice to solve complex engineering problems, carrying out innovative practice training for graduate students, combining with the guidance of graduation design for undergraduate students in BIM application of building information technology, effectively strengthens the green building development consciousness of graduate students majoring in architecture and civil engineering. [3]

Building Information Modeling (BIM) has received a great deal of attention in recent years in both academia and industry. BIM not only brings economic benefits to developers, but also provides a platform for scientific research. Planned BIM internships during graduate school are crucial to the development of graduate students' practical skills.

3. THE MAIN CONTRADICTIONS OF THE CURRENT SITUATION OF CULTIVATION OF MASTER TALENTS IN CIVIL AND HYDRAULIC AND ARCHITECTURE IN LOCAL UNIVERSITIES

At present, the requirements for advanced BIM talents in the construction industry are no longer limited to the proficient use of modelling software. The training of BIM talents in universities should not be limited to mastering solid basic knowledge, but should also cultivate the creative spirit and innovative ability of graduate students in BIM technology. Of course, the cultivation of innovative ability cannot be achieved overnight, but requires a complete set of innovative talents training program and clear training objectives.

Our training goal is to cultivate high quality talents with scientific research level and certain practical foundation. With the background of civil engineering and architecture disciplines, we provide each graduate student with an on-campus research mentor and an off-campus work practice mentor. We combine industry and education by implementing a dual tutor system. At the same time, the tutor system is implemented, in which the tutor makes a special training plan for the students according to their disciplinary background, knowledge reserve and personal interests, so as to help them choose a suitable research topic and provide professional guidance, thus cultivating innovative talents with strong research ability and outstanding practical ability for society.

The lack of BIM talents in the domestic construction industry can be divided into two categories: technical talents (BIM modelling engineer) and management talents (such as project BIM technical manager and BIM project director), and the reasons for the current lack of BIM talents in the domestic construction industry can be summarized as follows：

BIM modelling engineers need both engineering professional knowledge, knowledge of drawings and software operation ability. But general college education does not cover these points. BIM technology is a tool to promote the integration of communication between different places/multi-phase/multi-professional/multi-people. Talent's cross-domain integration ability and experience is very important, but such both professional and management candidates are difficult to train quickly. The construction industry generally lacks strategic planning and management system adjustment to correspond to the training of in-service personnel. It

is difficult for trainees to balance work and training, and the effectiveness of training is limited.

In short, the construction industry is currently facing the problem of BIM talent gap is very prominent. There is a gap between the BIM talents training in domestic universities and the industry demand. [4] How to strengthen the quality and intensity of education and training is the issue we should pay attention to.

Specifically, how to change the status quo of traditional education that lacks innovative ability for students? How to break through the limitations of traditional education? How to abandon the simple transmission of knowledge and the stereotypical teaching attitude? How to improve the cultivation methods so that graduate students can have a sense of self-innovation while fully utilizing the strengths of their own disciplinary abilities? How to support them through the system to combine their innovative consciousness into the research practice to solve practical problems? These are the challenges of professional degree graduate education nowadays.

4. SUGGESTIONS FOR THE TRAINING MODE OF PROFESSIONAL MASTERS IN CIVIL ENGINEERING AND HYDRAULIC AND ARCHITECTURE BASED ON BIM COLLABORATIVE PLATFORM

We should reconstruct the curriculum system and teaching content by relying on the BIM collaborative platform in order to strengthen the cultivation of interprofessional and interdisciplinary composite talents. We should focus on strengthening engineering practice ability, engineering design ability and engineering innovation ability. This process should focus on the integration of BIM technology and computer-based courses, and the integration of BIM technology and traditional construction technology courses.

By introducing a complete knowledge system of BIM technology courses in the training program of graduate students in civil engineering and water conservancy and architecture, students can build a complete BIM knowledge framework. The general courses should be in line with the social needs of science and technology development and popularize relevant theoretical knowledge, so as to improve the application and practical ability of graduate students.

By mobilizing the enthusiasm and initiative of teachers and students, we can reform the existing postgraduate teaching and cultivation mode, so as to tap the innovative consciousness of postgraduates and exercise the innovative thinking ability of postgraduates to the greatest extent, thus improving the quality and effect of cultivation.

By accelerating the cultivation of top-notch talents with good knowledge structure, ability structure and comprehensive quality characteristics, we can provide a continuous supply of high quality and high-level talents for the development of the construction industry. It also provides certain reference for the teaching and management of different disciplines.

The formal BIM education and training provided by the university should contain the following contents：

Training purpose: teaching basic theory and cultivating basic technical practical ability.

Execution method: The full-time teachers are responsible for teaching the basic theories related to BIM, while the professional teachers are responsible for teaching the basic operation ability of BIM software. In this way, we can achieve the effect of complementing each other.

Implementation focus: actual cases should be used for teaching to shorten the adaptation period after students enter the workplace.

To sum up, the cultivation of BIM talents should start more from colleges and universities, so domestic university BIM education should pay attention to：

formal school curriculum should be separated from industrial short-term courses.

Emphasis on BIM formal education for the cultivation of basic concepts and abilities.

BIM curriculum planning should pay attention to the integration of original professional courses and BIM technology.

Since there are great differences among graduate students in terms of research ability, practical ability, innovation ability, and interests, etc., we should take into account the actual situation of students. In the process of talent cultivation, we should start from the actual students and teach them according to their talents by targeting the characteristics of different students and student groups. In this way, the maximum potential of each student can be brought into play, so that students can compete with innovation and be distinguished by their characteristics.

We should also take problem discovery and problem posing as a breakthrough to cultivate the innovative ability of graduate students. Guide students to develop a spirit of reflection, criticism and questioning, and to learn to discover problems in the intersection with other disciplines, which no longer limited to this discipline.

We found through our research that although graduate students in civil engineering and water conservancy and architecture have about 30 weeks of internship time, only some of them can complete the internship program within the specified time. Real estate

developers or design institutes have almost become the agreed target units for these postgraduates during the internship. [5] However, some students do not pay much attention to the internship, so they do not make full use of it to improve their abilities.

This phenomenon is not unique to local institutions. The reasons for this include: In-school instructors do not pay attention to it. This lack of attention is reflected in the fact that the training model and school evaluation indicators are based on theoretical research. Teachers pay less attention to internship experience.

No cooperative relationship between universities and enterprises. Some postgraduate internship enterprises deviate from the direction of postgraduate subjects in internship projects because they do not have any interactions with universities. The requirements for graduate students' internship are lax. Postgraduates do not have the concept of selection for internship enterprises, and apply for internship enterprises in a general way. [6] Postgraduates are not highly motivated during the internship, and the results of the internship are not up to the standard.

In the internship stage we require graduate students to learn the advanced technology and advanced enterprise culture of enterprises. Postgraduates must deeply carry out engineering practice activities based on BIM technology, through which they can participate in enterprise technology innovation and engineering development. This also cultivates students' professionalism and professional ethics.

We should take the social demand for talents as the entry point, and aim to cultivate innovative talents based on construction information technology in civil engineering, water conservancy and architecture degree. In this way, we can figure out a different model from the traditional "on-campus" talent cultivation: advocate and encourage graduate students to select cutting-edge BIM-related research topics, and conduct research by relying on specific practical application of BIM technology related projects under construction. In this process, it is not necessary for social projects to look for schools, but also for schools to look for social projects. Only by letting scientific research out of universities and combining with specific applications, we can form a set of industry-research combination training system and bring into play the efficiency of talent training from the supply side.

5. CONCLUSION

With the rapid changes in science and technology, new information technology profoundly affects all aspects of society. We urgently need to cultivate new talents in the construction industry with the ability to apply construction information technology in the new era of profound social change. The new era needs high-level builders. In the current training of high-level talents in civil construction, the training of specialized talents and research topics need to actively dovetail, participate and integrate into the requirements of industrial informatization research and development.

ACKNOWLEDGMENTS

This research was financially supported by University-Industry Cooperation Collaborative Education Program of the Ministry of Education (Grant NO. 202102213045 & 202102478017) and 2021 graduate quality engineering program at Wuhan University of Science and Technology (“Research on Innovative Talent Cultivation Model of Professional Degree Graduate Students under BIM Collaborative Platform”).

REFERENCES

[1] LI Jiancheng, The Countermeasures of Architectural Education to Fit BIM Age, Journal of Human Settlements in West China., vol. 29, Chongqing, 2014, pp. 1–5.

[2] Marc Aurel Schnabel, Architectural Education in the BIM-Age, New Architecture., vol. 36, Wuhan, 2012, pp. 25–27.

[3] LI Fei, CHEN Xiangyun, ZHANG Bo, Exploration on the Integration of Industry and Education and the Cultivation of ‘Building Informatization +, High-level Civil Engineering Talents., vol. 402, Wuhan, 2020, pp. 29–30.

[4] LIU Ji-ying, Research on BIM Practice Based on Postgraduate Training of Civil Engineering, Education Teaching Forum., vol. 489, Shijiazhuang, 2020, pp. 317–318.

[5] Luo Lan, Zhou De, Jiang Shuihua, Research on the training strategy of top innovative civil engineering talents under the guidance of BIM, Shanxi Architecture., vol. 46, Taiyuan, 2020, pp. 181–182.

[6] FU Xia, WAN Junjie, Towards an Integration of Professionalism A Preliminary Study on the Teaching Framework of BIM Virtual Construction Design, Architectural Journal., vol. 608, Beijing, 2019, pp. 105–110.