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Teaching Reform of Innovation and Entrepreneurship Integration Based on BIM Technology Application Course

Qiankun Gu[1]*, Wenyan Liu[1], Cuiling Zhang[2]

[1]School of Architecture and Environment, Ningxia Institute of Science and Technology, Shizuishan 753000, Ningxia, China
[2]School of Innovation and Entrepreneurship, Shizuishan 753000, Ningxia, China

Corresponding author: Qiankun Gu, 18395129929@163.com

Abstract: All industries and fields are moving towards digital transformation, and the construction industry is also developing in the direction of digital construction. Building information modeling (BIM) technology is not only a key force to achieve digital construction but also provides new possibilities for innovation and entrepreneurship, and is an important starting point for the transformation and development of the construction industry. This paper aims to explore the practice of the integration of entrepreneurship and innovation in BIM technology application courses in colleges and universities, reform the talent training mode for engineering management professionals, and take BIM technology as a starting point by integrating entrepreneurship and innovation education into BIM course teaching, strengthening the integration of specialized innovation and innovation, strengthening the construction of BIM professional associations, deepening school-enterprise cooperation, and building a "BIM+ entrepreneurship and innovation" faculty team. To promote the integration of innovation and entrepreneurship education and BIM courses, improve students' scientific research and practice ability and level, and cultivate senior application-oriented talents with strong innovation and practice ability to meet the needs of social development.

Keywords: BIM technology; Curriculum system reform; Mass entrepreneurship; Innovation

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1. Introduction

With the change of the times, the construction industry is actively developing digital construction and carrying out transformation and upgrading. Building Information Modeling (BIM) technology is an important starting point for the engineering industry to realize digital construction, and professional talents are an important support for digital construction. With the development of teaching activities such as BIM enrollment, BIM association, BIM graduation design, and BIM competition in colleges and universities, innovation and

entrepreneurship activities based on BIM technology are also continuously carried out, providing ideas for the reform of BIM technology-related courses. How to organically integrate BIM technology application courses with mass innovation education to meet the talent needs of current enterprises is an important issue that universities need to face. Therefore, colleges and universities should identify the talent gap, innovate teaching methods, introduce courses, deepen cooperation between universities and enterprises, and simultaneously improve students' BIM technology professional ability and innovation and entrepreneurship ability to promote college talents to serve local economic development.

2. BIM technology teaching

BIM technology is mainly used to build an information management platform integrating planning, design, construction and operation. At each stage, the applied database can be updated, the data resources can be optimized in time, the problems in the follow-up work can be reduced, the efficient control of the project implementation process can be realized, and the scientific and reasonable project plan can be formulated [1].

BIM technology runs through the engineering industry all the time. It involves the combination of theoretical knowledge and practice in many fields to make up for the difficult problem of practice in the construction industry. Therefore, the training of BIM technology talents must ensure the coherence and logic of knowledge, that is, to ensure that the teaching content of BIM technology courses can be connected with other courses or professional knowledge [2]. From the overall point of view, BIM technology application courses should be innovated based on basic theory and practice modules to promote application-oriented undergraduate students to become "professional + innovation and entrepreneurship" composite talents.

3. The analysis of the problems faced by the traditional BIM technology course teaching

3.1. Lack of supporting resources

On the one hand, the teaching quality of BIM teaching in the market is uneven, relatively lacking in practicability and teaching, and it is difficult to become a powerful auxiliary tool for BIM teachers. Teaching materials are rarely integrated into the education of innovation and entrepreneurship. For various reasons, teachers lack the training to develop students' entrepreneurship and innovation ability [3]. On the other hand, BIM technology involves a wide range of design content, the usual computer cannot meet the needs of teaching. The school needs to have the corresponding hardware configuration as support. Although some schools have set up BIM technology centers, the resources are limited and it is difficult to popularize. Due to the limitations of objective conditions, the teaching of BIM technology is more confined to the theoretical level, and the practical links are insufficient, which makes it difficult for students to have the opportunity to innovate [4].

3.2. Lack of cross-cooperation

In the past, universities often positioned mass entrepreneurship and innovation education as the "second classroom," independent of professional education. Although some schools have set up courses on innovation and entrepreneurship education, there is still a lack of courses combining entrepreneurship and innovation education with the professional characteristics of disciplines. The BIM entrepreneurship and innovation platform lacks professional guidance concepts and needs to strengthen top-level design [5]. In addition, due to

different professional teachers' different understanding of BIM, the teaching focus will also be different, which may lead to the solidification of the training model of entrepreneurship and innovation.

3.3. Lack of "double-qualified" teachers

BIM technology is a new technology software, teachers need a strong comprehensive ability, master the theory of BIM technology and engineering practice ability. However, there are relatively few BIM teachers in the school, and compared with some mature courses, some BIM teachers still have a lot of room for improvement in the teaching level of this course, and teachers with knowledge about entrepreneurship have no time to learn due to the heavy burden of professional course education [6].

4. The teaching reform strategy of mass innovation integration based on BIM technology application course

4.1. Integration of entrepreneurship and innovation education into BIM course teaching

With the changes of the times, the construction field is developing in the direction of digital construction and intelligent construction, and the innovation and entrepreneurship activities based on BIM technology in colleges and universities are also constantly carried out. To simultaneously improve students' BIM technology ability and mass innovation literacy, teachers can integrate mass innovation education into BIM course teaching and set up related theoretical or practical courses [7]. Application in teaching: In the BIM course, combined with the activities of college students' innovative project planning "BIM application innovation," the teaching process guides students to carry out architectural design based on actual engineering projects and use BIM software for model construction and simulation application, to promote the organic integration of entrepreneurship and innovation education and professional education [8]. In addition, relying on the internet technology, the teaching method combining online and offline is constructed. On online, we will develop and integrate innovative and entrepreneurial education resources with strong interaction and rich content; Offline, digital mass entrepreneurship cases and knowledge such as animation and text will be integrated; Encourage students to participate in school-enterprise cooperation projects, BIM technology competitions, etc., strengthen the combination of students' theory and practice, and enhance students' learning effect on BIM technology [9].

4.2. Strengthen the integration of specialized innovation education

4.2.1. Introducing skills competition into professional education to promote teaching and learning through competition

Introducing the professional innovation competition based on the application of BIM technology into the curriculum teaching can make students familiar with the creation, analysis, and management process of building information model through hands-on operation of BIM software, to improve their practical skills [10]. At the same time, students will put forward new ideas and solutions in the application of BIM technology in the practice process to cultivate students' innovation awareness and innovation ability.

BIM competition is introduced into the teaching of professional courses. By taking the competition project as the carrier, the course content is divided into several project tasks so that students can master BIM technology and professional knowledge in the process of completing the project tasks. BIM competition projects account for 30 points in the course assessment. Specific requirements are as follows: At the beginning of the semester, students are divided into groups, task requirements are formulated, and assignment books are issued. According

to the requirements of assignment books, students divide up the work and complete the innovative plan; In the mid-term, the plan is guided and demonstrated. According to the application of BIM technology in the whole construction cycle of the course theory, students can find innovation points and learning objectives by consulting literature and combining with actual cases; At the end of the semester, students will submit results according to the task requirements, including BIM model creation, model rendering and roaming, model application and summary report. They are required to expand the application of BIM technology in the whole project process in addition to the course explanation content, and each group will expand at least two application parts to closely integrate the course teaching and competition and realize the promotion of teaching and learning through competition. This will lay a solid foundation for the application of high-quality double-creation projects based on BIM technology.

Finally, the design of the curriculum system needs to be implemented in the classroom. Teachers should adopt diversified teaching methods in teaching methods, such as case teaching methods, project teaching methods, group cooperative learning methods, etc., to improve the teaching quality of the classroom. At the same time, a diversified assessment and evaluation system should be established to comprehensively evaluate students' levels and abilities through the combination of process evaluation and terminal evaluation.

4.2.2. Set up project-based courses to enhance innovation and entrepreneurship

The BIM project-based course aims to require students to use advanced building information modeling technology to solve practical problems, which encourages students to constantly explore new methods and new ideas and cultivate innovative thinking and innovation ability [11]. Innovation and entrepreneurship education emphasizes the cultivation of students' innovative consciousness and innovative spirit, which is in line with the goals of BIM project-based courses and jointly provides the soil for students to innovate.

The university-level BIM technology application project system course has been declared. The specific implementation content is based on the cultivation of the outstanding talents of the "Green Wisdom Class" of the university's civil engineering major of 2024, and the whole process of BIM project system personnel training is formulated. The BIM+ mapping ability is cultivated for freshmen, the BIM+ project training for sophomores, and the BIM+ application ability training for juniors. Senior students achieve BIM+ graduation design + practice training, adding innovation and entrepreneurship education content and assessment in BIM project-based courses, such as entrepreneurial case analysis, innovation method introduction, etc., or setting BIM project tasks related to innovation and entrepreneurship, encouraging students to propose innovative solutions and considering the commercial feasibility of the project [12]. At the same time, it is necessary to strengthen practical teaching by establishing BIM innovation and entrepreneurship practice bases, organizing students to participate in BIM-related innovation and entrepreneurship competitions, encouraging students to participate in practical engineering projects, and cooperating with enterprises to carry out BIM projects to enrich students' practical experience and improve students' innovation and entrepreneurship level [13].

4.3. Strengthen the construction of BIM professional associations and create a BIM innovative second classroom

Relying on the project-based curriculum and combining the training direction of application-oriented talents with the school's professional characteristics, develop innovative BIM professional associations, determine the learning tasks at each stage of the associations, locate the development goals of the associations, focus on the

innovative training of BIM technology, and carry out targeted activities and construction. At the same time, it cooperates with the school's infrastructure department and architectural design unit to put the practice of the association into practice, which is more conducive to finding and solving problems. For example, I participated in the school's proposed projects, from the establishment of pre-design building models, bidding, and drawing review modules to the simulation of the construction process, so that members could exercise their abilities in practice. Carry out BIM modeling competition, set a specific building project or scene, require members to complete the modeling task within the specified time, and organize professional teachers to review and award to stimulate members' learning enthusiasm and innovation ability. Establish cooperative relations with BIM software manufacturers, strive to obtain the trial version or education version of the software authorization, and provide a good software learning and practice environment for members of the community. Establish cooperative relations with construction enterprises, design institutes, and other units to provide internship opportunities for community members so that they can have access to actual work scenarios and projects and improve their practical ability and employment competitiveness [14].

4.4. Deepen cooperation between schools and enterprises, and promote the implementation of the mechanism of collaborative education between industry, university, and research

Relying on the construction of new engineering, the establishment of the industry-university-research collaborative education mechanism with enterprises is only limited to the framework agreement, and there is still a big gap from the actual implementation. To promote its real landing, the next step is to take the initiative to contact enterprises, implement the school-enterprise cooperation project, and co-direct the BIM innovation competition, the innovation project, and BIM-related graduation design. Enterprise mentors bring cutting-edge knowledge, the latest industry trends, the latest engineering cases and other resources to provide theoretical support for students' innovation, while allowing students to find the right direction for employment, to promote the implementation of school-enterprise cooperation, industry-university-research collaborative education mechanism, to promote students' real participation, deepen their understanding of knowledge and knowledge, to effectively enhance learning interest.

4.5. Build a "BIM+ double innovation" teaching team to improve teaching quality

Colleges and universities should cooperate with enterprises to build two teams of "entrepreneurship teachers" and "entrepreneurship mentors." Full-time BIM teachers should be selected by schools to participate in innovation and entrepreneurship training, to improve their teaching ability of entrepreneurship and innovation; Strengthen cooperation with enterprises, arrange BIM teachers to go deep into enterprises regularly to participate in all aspects of production, operation and management, and encourage teachers to work with enterprises to carry out technical projects such as product design and process innovation, to enhance teachers' practical and innovative ability; Introduce and employ excellent technicians or senior managers with rich experience as part-time teachers, further enrich and optimize the BIM teaching team, and promote the deep integration of entrepreneurship and innovation education and BIM teaching.

5. Conclusion

In conclusion, all industries are upgrading to digital transformation, and the construction sector is no exception. BIM technology is an important support for the digital development of the construction Bank industry, and

application-oriented universities are an important reserve position for BIM technical talents. In the face of enterprises' demand for talents in the new era, colleges and universities can cultivate students' innovative thinking, entrepreneurial ability, and practical skills by deepening the integration of BIM technology and mass innovation education, and also provide more outstanding talents with innovative spirit and entrepreneurial ability for the society.

Disclosure statement

The authors declare no conflict of interest.

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