

# Innovative Research on BIM - Based on Interdisciplinary and Interdisciplinary Talent Training Model

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**Abstract**—BIM method is adopted to cultivate students' ability to solve "complex engineering problems", conduct interdisciplinary and interdisciplinary training, train students to become inter-disciplinary talents, and improve the teamwork ability of teachers and students. The core of BIM education concept is "collaborative work and information sharing". It promotes the talent cultivation mode of "BIM curriculum - BIM collaborative design - BIM professional practice", changes the existing talent cultivation mode of colleges and universities, and changes the teaching and learning concepts of teachers and students in colleges and universities. It also helps to change the status quo of teachers and students in colleges and universities, exercise the language expression ability of teachers and students, strengthen professional and professional communication, interpersonal communication, and improve the level of all professional development; effectively integrate school BIM resources and save resources.

**Keywords**—BIM, cross major, joint culture, collaborative design, talent

## I. INTRODUCTION

Building Information Modeling (BIM), based on 3d digital technology, integrates engineering data of various relevant information of building engineering projects, and is a digital expression of project facility entities and functions [1]. It has the characteristics of "cooperative work and information sharing". The emergence of BIM is a technological revolution, and the cultivation of BIM talents is an important task for schools. Currently, what colleges and universities lack is the overall BIM education concept that is cross-disciplinary and cross-disciplinary in the construction industry. The overall education concept of BIM is of great significance to adapt to the transformation of development mode of the construction industry, strengthen students' awareness of energy conservation and emission reduction, green development, and improve students' employability. The overall education concept of

BIM will change teachers' teaching concept and students' learning concept at the same time. Architectural design companies have begun BIM design more than a decade ago. It is an urgent requirement for building owners to assist and improve the information construction of building information model. In September 2016, the Ministry of Construction also issued the Outline of Informatization Development of Construction Industry in 2016-2020. Cultivation lag, our school is lack of good hardware and software support, teachers are insufficient and training lags behind. In addition, BIM stays in the conceptual phase, and training of person with ability is simply introduced. Even more colleges and universities are still waiting, rather than integrating BIM into the professional course, but the BIM is equivalent to a software program. Universities are in urgent need of developing BIM talents with their own characteristics and cultivating BIM talents required by enterprises. At present, Harbin Institute of Technology undergraduate students have not opened BIM courses; Dalian University of Technology is carrying out preliminary collaborative design. Xi'an University of Architecture and Technology does not offer BIM courses to undergraduates. In more than a year's research, BIM teaching in many colleges and universities is still in the software stage, and BIM education has not formed a system in colleges and universities in terms of multiple majors and disciplines, and the mode of BIM interdisciplinary and interdisciplinary joint cultivation of talents has not been formed.

## II. INTERDISCIPLINARY AND INTERDISCIPLINARY JOINT CULTIVATION OF TALENTS

BIM education is adopted to "work together and share information" in multi-specialty and multi-discipline, so as to cultivate cross-disciplinary talents. Save school resources, change teachers' concept of work, work together in multiple disciplines, and share multi-disciplinary information; change the students' learning concept, not only to learn their own professional, but also cooperate with other students to learn together, and share their professional information to other professional students; cultivate the spirit of teamwork and collectivism among teachers and students. It provides a new direction for school transformation and development and innovation and

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entrepreneurship education.

#### A. *Set up special BIM institutions*

School with civil, mechanical and electrical construction, and management and other multi-disciplinary professional characteristic, effective integration of school resources, plus tools for BIM teachers of the teaching and research as an interdisciplinary, cross major, cross-sector platform for the exchanges and cooperation, give full play to the advantages of more professional teachers team, and further promote the university teachers in the application of BIM technology in teaching and research, to guide different students collaborative innovation of graduation design, the college students competition, entrepreneurial activity can play a bigger role, explore a department of teachers and students collaborate to carry out the teaching and research practice, new ways of personnel training,

#### B. *Popularize and apply "manual cartography - CAD cartography - BIM cartography" three-stage cartography education*

Traditional manual drawing and 2d graphics, such as dot, line, face the space geometry problem solving education, now engineering drawing into the era of computer graphics, 3d drawing in full swing, computer 3d graphics technology become the teaching of engineering graphics course of teaching, a platform of BIM technology is more professional, teach students in the BIM model refers to the 3d building model, cultivate students' space imagination.

#### C. *BIM multi-specialty collaboration*

Architecture, civil engineering, water supply and drainage engineering, building environment and energy application engineering, building electrical and intelligent engineering management and six undergraduate majors to complete the BIM graduation design. Collaborative design fully demonstrates interdisciplinary and professional collaboration, and it has important practical significance to improve students' practical application ability, professional level, students' innovation consciousness and team spirit. The core content of BIM collaborative design is that all majors use the same set of standards to jointly complete the same project in the same environment. The most important thing for BIM collaborative design is centralized storage of work content, centralized management of work environment and centralized control of work process.

#### D. *BIM teaching project*

The construction of BIM laboratory and training base enables students to have a large number of opportunities to practice BIM modeling and construction related work in practical projects, improve students' practical ability, realize the seamless connection between teaching and social application, enable students to get jobs upon graduation, and solve the problem of long training cycle for fresh graduates in enterprises [2]. In order to meet the demand for BIM talents in the application of BIM

technology in enterprises under the new situation, students' ability to learn BIM is exercised through practical engineering projects. To guide students to participate in project whole process simulation of the parties based on BIM engineering comprehensive centralized management, responsible for the formulation of students understand BIM standard, the establishment of the management system, and participating the BIM application control techniques, for the students overall understanding of BIM technology in the application of the project is to provide an interactive environment, at the same time, through the project lead students to participate in BIM competition. To cultivate BIM professional talents more adapted to the needs of society, and comprehensively enhance the core competitiveness of school talent training.

### III. BIM INTERDISCIPLINARY ACROSS MULTIPLE PROFESSIONAL COLLABORATIVE DESIGN

BIM is a collaborative graduation project of civil engineering and architecture related majors (civil engineering, environment construction, power construction, water supply and drainage science, architecture, engineering cost, engineering management). Multiple majors and disciplines cooperate to complete the engineering design and engineering management of the model, truly achieving the effect of "collaborative work and information sharing". During the whole process of construction, all participants of BIM collaborative design can continuously optimize and process the model information, and transmit the information to each other accurately and quickly, which greatly improves the efficiency of project management [3]. When BIM technology has not been widely applied and promoted in the construction industry and various universities, it is difficult for technicians from different majors and design and construction units to carry out technical communication and collision inspection, which leads to a large part of unnecessary rework and resource waste. The emergence of BIM technology solves this contradiction in a timely manner. And combination of BIM technology to today's students' graduation design in the field of construction engineering related, can give students a good experience to BIM technology into their own professional design brings convenient, feel the blend each other mutual infiltration between disciplines system, through their learning professional knowledge, also learned other professional knowledge, learning through the skills they need to understand the various stages of construction projects.

In the application of BIM technology in ring as an example, BIM software integrated in the HVAC line, can set the level of the pipeline position and vertical position, the size of the pipeline, and the size of the elbow, the size of all kinds of valve parts, and more specific show each line position, can at any time by the three-dimensional display of pipeline relative position adjustment, more accurate pipeline avoiding collision, achieve the purpose of control is clear, save a space for the owners, convenient to construction. In the wind system design, make it a system

with BIM, can use RevitMEP to simulate the actual operation, which can clearly indicate the new wind in each pipe speed and friction resistance, until the end of the tuyere. And in the unreasonable place will be marked with the set color, so that the designer can re-choose the size of the duct through the logo, or re-design the system pipeline direction. In water system design, by establishing the model selection of equipment and pipe system, can be simulated by the software running, shows the running state of each device, the velocity of fluid in pipe and resistance, unreasonable area will be expressed with set color, designers can use these data for equipment selection, the determination of water pipe diameter can also through the analysis of the model, using the software auxiliary piping system designers to design more reasonable.

#### IV. BIM INTERDISCIPLINARY PROFESSIONAL PRACTICE

Compilation of BIM series of teaching materials: application and practice of architectural design BIM, application and practice of electromechanical design BIM, application and practice of structural design BIM, and basis of BIM mapping, with 25 participants and 10 units participating in the compilation.

Students participated in the national BIM competitions for college students, "promoting education through competition" to train the student team, and integrate the students into the team during the competition, such as the "Sware Cup" national college students BIM competition, BIM graduation design competition, energy saving and emission reduction competition, etc. Students cooperated with multiple majors to complete the competition. They were awarded the second prize of "Sware Cup" national college students BIM skills competition and the special prize of Guanglianda national college students BIM graduation design.

BIM teaching and research is a long-term process, should be one step a footprint, BIM solid foundation teaching, strengthen the BIM concept, reasonable application of BIM, the BIM advanced enterprise lead to the school, the formation of a strategic partner, teacher training, teaching platform, practice base, new technology promotion base, double gen incubation park is adjust measures to local conditions to create a plan to learn advanced technologies, plus BIM to cultivate talented. Set up BIM practice bases in Harbin, Changchun, Shenyang, Shanghai, Zhengzhou, Xi'an, Wuhan and Kunming to train students in practical projects. It has obtained 16 projects of collaborative education from the ministry of education.

#### V. SUMMARY

As China's universities under the background of rapid development of construction industry technology, they should take it as their own responsibility to cultivate professional BIM talents. Colleges and universities should add the teaching of BIM theory, BIM practice, BIM collaborative graduation design and other links to the talent training program to jointly train talents across disciplines and majors based on BIM, so as to form an innovative mode of "BIM curriculum - BIM collaborative design -BIM professional practice". Firmly grasp the industry demand, employment guidance two external driving forces, closely around the top-level design, curriculum system, teachers, training base and other internal driving forces, so that the vocational characteristics of BIM professional application personnel training mechanism to operate steadily [4]. Make the large civil engineering graduates with BIM application skills, it is worth learning for the whole building industry, positive, only in this way to cultivate graduates are the new energy is the main force that can play the "battle", only in this training scheme can we grew up in in the process of into society to work more comfortable and more comfortable, save the state and society and enterprise training talents of the cost of capital. The popularization and application of BIM technology will greatly improve the management level at all stages of the project, give play to the advantages of collaborative management, improve the quality and efficiency and shorten the construction period. Therefore, the establishment and implementation of BIM teaching system in colleges and universities is of great strategic significance for the future marketization of talents [5]. It is believed that with the progress of the society and the efforts of the school, BIM technology will be more widely applied in various fields of the construction industry in the near future, and will also bring more contributions to the society, the country and the people.

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