Research on Cross-specialty Organization of Architectural Specialty Based on BIM Graduation Project

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Abstract

BIM technology has been used in the innovation and development of the construction industry, the architectural specialty in the application-oriented universities is training BIM technology-applied talents in various ways. Compared to six kinds of training ways, the author believes that BIM-based cross-specialty project design can train students to comprehensively use basic theory, basic knowledge, basic skills, basic skills of this specialty to analyze and solve practical problems, enhance professional quality, practice BIM collaborative application, which is conducive to solidify professional basis, broaden professional outlook, improve the overall quality, train BIM applied talent with innovative consciousness.

Keywords

Cross-specialty, graduation project, BIM.

1. Imbalance between Supply and Demand of BIM Talent under the Background of Building Information

BIM technology is an important technological means to promote the innovation and development of China's construction industry, and its promotion will have an immeasurable impact on the transformation and upgrading of China's construction industry. According to the "China Construction Industry Information Development Report (2015: BIM is applied in development deeply)" survey data show that: 43.2% of enterprises has used BIM technology in the project which has begun, and application points began to gradually expand to the each stage of all life cycle of construction project. At present, BIM technology has started from concept introduction stage (1998-2005), experience theoretical research and preliminary application stage (2006-2010), develop current rapid development and in-depth application stage (2010-), and personnel training has become the main factors that influence rapid promotion and application of BIM technology. According to the BIM technology application situation survey in Wenzhou area, 72.44% of enterprises said that the most pressing thing of BIM application of is to train BIM talent currently.

With the advent of the construction information age, how to update the old concepts, establish new ideas, redefine goal of personnel training, innovate training mode, construct curriculum system, train the BIM technology talents have been inevitable problems of research and teaching in the architectural specialty of application-oriented universities. It is imperative that teaching in architectural specialty of application-oriented universities actively integrate BIM technology.

2. Comparative Analyses of the Existing BIM Personnel Training Mode

With the wide promotion of BIM technology in construction industry field nationwide, BIM talent demands increase sharply in the industry, which force BIM education of architectural specialty in universities must act to ensure continuous and stable supply of BIM talent of architectural specialty. According to the survey of architectural specialty of 17 high vocational schools in Zhejiang Province, the modes of training BIM talents in high vocational colleges are roughly divided into six categories:

2.1 Open BIM Specialty

At present, only one higher vocational college in Zhejiang Province establishes BIM specialty and recruit students-Zhejiang College of Construction, this college began to recruit students of construction engineering technology (BIM technology) specialty. In fact, here the construction

engineering technology (BIM technology) specialty is one direction of architecture engineering technology specialty in strict sense, the author compared courses between construction engineering technology (BIM technology) specialty and construction engineering technology in this school, the basic courses and professional courses of two specialties are the same, and there are three different courses (as shown in the table below). Under the condition that BIM modeling talents are urgently needed currently, this BIM talent training mode based on engineering and technical specialty is an effective way to respond to the demand of talent market. But this practice only promotes BIM talent in the construction field, and the engineering technologies are divided into traditional and BIM technology two categories, but it is an expedient measure.

Table 1 Difference between construction engineering technology (BIM technology) specialty and construction engineering technology in courses

specialty	different courses	different courses	different courses
construction engineering technology(BIM technology)	BIM modeling technology	BIM related software application	BIM technology practice
construction engineering technology	measurement and valuation of construction engineering	engineering cognition and practice	post-practice simulation

2.2 Open BIM Technology Course

The separate courses on BIM are divided into two types: the first is to establish the theoretical course of BIM basic concept, the amount of class hour is very few. Some higher vocational college with smaller scale, weak resources and limited training equipment tend to introduce BIM knowledge into the teaching of architectural specialty in this way. The other is to open a BIM modeling course, most schools open revit software teaching currently. BIM modeling is trained as one developed skills of students, and open a small door for students who engage in the work on BIM. No matter what type of course, these students who are trained re-accept BIM's system training after entering into the community.

2.3 Introduce Teaching Content of BIM Technology Application into the Traditional Professional Courses

The BIM technology applications are introduced into the traditional CAD, cost measurement, construction organization and management and other courses teaching. It can achieve good teaching results in the application technology of BIM specialty in this way, but the concept of BIM coordination and model transfer cannot be trained, only as the basic teaching of BIM, and require teachers of relevant specialty courses to have application ability of BIM technology, and it is more difficult to achieve for teacher resources in many colleges at present.

2.4 Open Studio or Club

Many schools open BIM studio or club, which use occasional lectures, network teaching, skills competitions and other ways flexibly and diversely develop training of BIM application ability. The equipment funding of this kind of training mode is often difficult to guarantee, in addition, the evaluation system is relatively loose, the training effect are greater influenced by the individual enthusiasm of student leaders and guidance teachers, the sustainable development has some difficulties.

2.5 Laboratory Model of Industry-University-Research Integration

The industry-university-research integration laboratory can promote the in-depth application of construction information BIM in the teaching in theory, the enterprise play its strong engineering practice ability, proficient software operation and other advantages, college play its strong theoretical

ability, research and learning ability advantage, it is very effective BIM talent training model, but the beneficial students will be fewer.

2.6 Open the BIM Project during the Graduation Project Phase

Some schools carry out BIM project teaching in the graduation project stage. In recent years, Glodon Company, Luban and other domestic mainstream BIM software companies organize BIM graduation project competition of national college students each year, the schools connects graduation design tasks and contest tasks, students complete the task, which is completion of graduation project. This way which open a BIM project in graduation project (currently basically carry out in the competition way) to solve the following problems: First, problems that some schools do not purchase BIM series software and unable to carry out teaching are solved, because the sponsor supply contest series software for free; secondly, the problem of shortage of teachers in the school is solved, because the software company will shoot video teaching materials; thirdly, BIM collaborative application ability obtains very good training, because the BIM projects are cross-specialty; fourthly, it is conducive to the training of innovative ability, according to the combined innovation theory, the integration point of cross-specialty knowledge is the innovation point which is most easily broken through in graduation project. The students who participate in BIM graduation project are not only skilled in the BIM technology applications of their specialty, but also have a more in-depth understanding on the BIM application technology of relevant specialties, they can directly participate in BIM application group of related specialties in enterprise after graduation. Through the cross-specialty BIM graduation project, you can consolidate professional basis, broaden professional perspective, improve the overall quality, and train BIM application talent with innovative consciousness.

Of course, the above four models are not mutually exclusive, Wenzhou Vocational & Technical College used means which integrates five models to train BIM technology application talents, and achieved good teaching results. In the following, this paper carries out specific discussions on graduation project implementation of cross-specialty BIM project.

3. Graduation Project Implementation Cross-Specialty BIM Project of Architectural Specialty

3.1 Training Objective

The BIM graduation design make the students systematically understand, know and master content, methods and specific measures based on BIM technology in the each phase of construction, master and understand business scene and business knowledge in actual project, so that students initially have the ability to use BIM software for the relevant specialty work, and lay a solid professional foundation for students to engage in BIM related work after graduation.

3.2 Project Type

The graduation project is designed in accordance with the students' professional background, but must reflect the ideas of "coordination" and "model transfer". Although the whole process of BIM project starts from the design, but because there is time difference problem in the designed tasks and following project management, cross-specialty BIM graduation designs are divided into two categories: one is started in the architectural design, structural design, mechatronic design, decorative design specialty and other design specialty organizations. The BIM collaborative platform is used to integrate the architectural design, structural design, integrated pipeline, decorative design integrated in a building information model, conditions permitting, and the cost information can also be integrated into it; the second category is carried out in engineering technology, construction costs, (construction equipment) and other specialties. This kind of projects generally use the turnover form of existing drawings, the scale can select building with 5000-30000 square meters, and complete model information transmission and application work in the project management phase. Taking Glodon BIM5D for example, the workflow is shown in the following figure

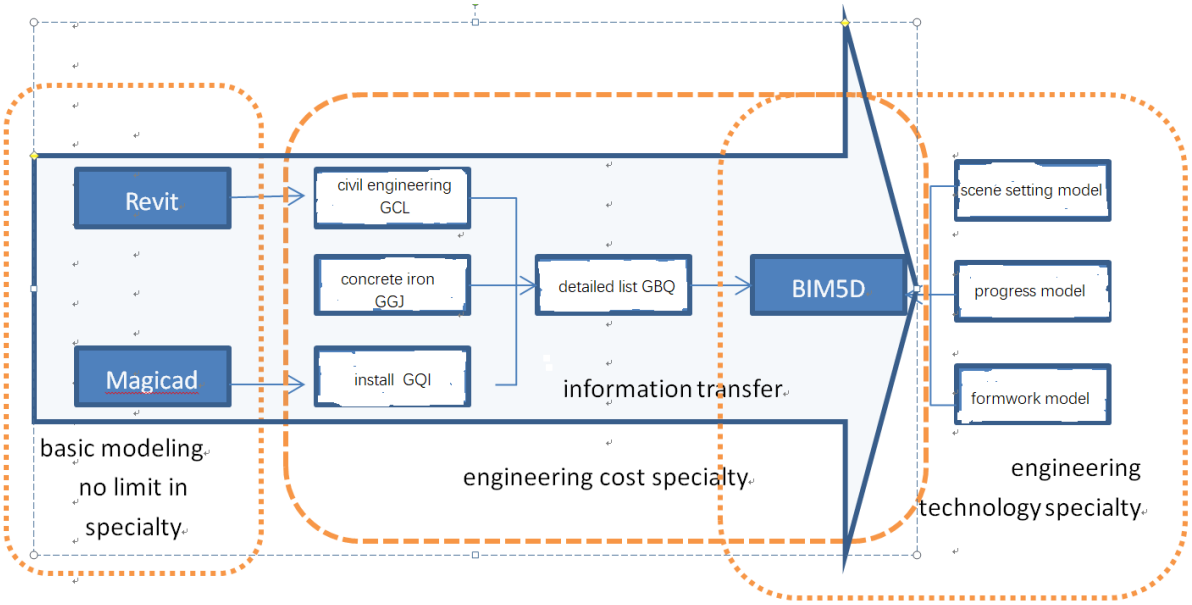

Figure 1.Broadband BIM5D Workflow

3.3 Team Building

The players with different specialties are organized in accordance with project types, every team is generally 3-5 people, the team selects a team member as the leader, the leader is in charge of division of labor, task implementation, progress control and results collection; according to the module broken into by head teachers, team leader prepares team members' division of labor plan, clears team members' task, requires each team members to complete their tasks on time, and requires each team members to familiarize all the tasks of team, can reply the query when teachers in the medium examination and reply. Finally, the leader leads the team members to arrange and collect all the documents in the BIM application process, and complete the PPT display content of project team.

Teachers are divided into head teachers and advisors, head teachers is in charge of the division of labor of the team module, progress control and coordination, head teachers generally need to receive BIM training in advance, but does not require professional proficiency, in fact, it is hard to be proficient in all fields. The advisors are mainly responsible for the professional guidance of professional field, need rich time experience in traditional engineering areas. Head teachers and advisors are rational division of labor; which not only ensures the smooth completion of graduation project, but also promote communication and mutual learning among teachers.

3.4 Process Control

The information flow controls among members are very critical in the cross-specialty team graduation project, whether the model information is transmitted to the next link in time, and it will be the decisive factor that the next job can be carried out or smoothly develop. Therefore, a system must be established to ensure that each member completes the phased work in time. In the opening stage of graduation project, the team leader should first draw the overall progress flow chart, determine the key control node, each member fully understand the overall task process, develop weekly plan based on the individual task module. We arrange a time for members to report and communicate once a week in the implementation process, strictly control in the control point and avoid progress out of control.

3.5 Results Orientation

The result of BIM graduation project may be the final result for a single specialty, which can play an independent role, for example, the list, formwork model and others need to be compiled separately, and the ultimate BIM5D model is only one of the results. Cross-specialty team BIM graduation project is generally the first contact for students, the role of file in the BIM process may not be in

place, so it requires a clear list of results, taking BIM graduation project of construction management category for example, the results list is as follows:

Table 2 results list BIM graduation project for construction management category

module	requirement	achievement form
model design of engineering project based on BIM	Submit the result documents of BIM design model engineering , model picture display (one plane, one facade, one 3D , and save the picture format)	model(one) plane model picture(one) facade model picture(one) 3D model picture(one) collision check picture(several)
establishment of bidding for construction project based on BIM	civil construction, concrete iron, installation model and valuation documents, business standard establishment: submit valuation project documents, and related reports	model(one) plane model picture(one) facade model picture(one) 3D model picture(one) report (concrete iron (concrete iron statistics summary sheet) civil engineering, installation list quota statistics summary sheet)(one) valuation document (one) Report "sub-project, unit price measures project list and valuation table"(one) bid control price report
model management of construction process of project based on BIM	construction progress schedule, 3D construction site layout, framework design model and plan	double code time-scaled logic network diagram or bar chart results file(one) 3D layout results document of construction site(one) foundation, main body, decoration model picture 3 sheets(one) formwork, scaffolding model file(one) formwork, scaffolding 3D model picture(one)

4. Case Conclusion

Comparing cross-specialty graduation project based on BIM and traditional graduation project, the differences are shown in Table 3 below.

Table 3 comparative analysis of cross-specialty graduation project based on BIM and traditional graduation project

viewpoint	cross-specialty graduation project based on BIM	Traditional graduation project
achievement form	many forms, embody individuality	single form, embody standardization
characteristics of the project	new technology application, cross-specialty team collaboration	mature technology application, complete on one's own
skill requirement	Strong opening, need exploratory learning	consolidate skills, focus on improvement of proficiency
teamwork	get full training	do not get full training
teaching management	difficulty is great, need to be flexible, meet the individual needs	unified scheduling, batch processing
guideline difficulty	need to synchronous learning, will take a wrong path, explore the excess counseling	High tutoring efficiency

The cross-specialty graduation project based on BIM open up the professional boundaries, which can achieve 1 +1> 2 effect, it does not only help improve the practical applicability of graduation project results, but also promote cooperation and mutual learning among students with different specialties, cultivate innovative consciousness. For cross-specialty graduation project, on the one hand, students

can play their own expertise, and become an irreplaceable member in a cross-specialty group, it has the inescapable task, students can cultivate independently spirit and ability; on the other hand, cross-specialty practice environment is closer to the real scene of social work, it is more conducive to cultivating students' communication and coordination ability; in addition, the graduation design works integrate the multi-specialty, multi-dimensional thinking, and have more practical applicability and innovation. But there are some difficulties in practice, such as the team's graduation project, it needs for joint efforts of members until the final, if the students obtain employment in advance during the period, cannot participate in team coordination, which will bring a great impact on complete completion of the whole team' task. There are some contradictions among school graduation project and students' employment in advance, college to undergraduate examination. So BIM team graduation design is not suitable for all students, specialty should provide various types, diversified graduation project types, and be good at guiding when the project is open, help students choose graduation project topics that suit them, reasonably deal with relationship among employment, entrance of a higher school and practice.

Acknowledgements

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