



# Application of BIM tools in technician training, a case of Ho Chi Minh City Construction College, Vietnam

NGUYEN, Tung Lam and NGUYEN, Thi Xuan

Ho Chi Minh City Construction College,  
265 No Trang Long Str., W. 13, Binh Thanh Dist., Ho Chi Minh City, Viet Nam.  
thixuannguyen.tcx@gmail.com

**Abstract:** In vocational training, keeping up with new technology is a challenge. Building Information Modeling (BIM) tools are now increasingly replacing traditional skills, which is irreversible advance in architecture and construction sector. This leads to changes in the curriculums of training courses, teaching and learning methods, especially in Technical Vocational education and Training (TVET). This article explores an application process of BIM tools in BIM Modeler or architecture technician training courses at Ho Chi Minh City Construction College as a case study, reflecting experience of change management toward new technology integration, its implication in and challenges for TVET's methodology. The author also recommends that cooperation between industry and TVET in training is one of the most effective solution to solve human resource problem for construction sector.

**Keywords:** TVET, BIM Modeler, competency.

Ho Chi Minh City Construction College (the College) has been specialized in vocational training for construction and architecture technicians since 1977. The College's vocational courses are continuously updated with new applications, enabling students to apply the knowledge effectively in industrial situation.

This article shares practical experiences through BIM tools training, one of the latest technology applications, with the desire to obtain extra ideas, knowledges and methods from BIM community.

## 1 The process of training architecture technicians

In the 1990s, the College began developing courses for architecture technician who were able to carry out the construction layouts by hand. Technicians training programs have been upgraded with CADD design software (CADD: Computer aided design and drafting operator). Students learnt to work in AutoCAD environment. Then, in addition to developing layouts, students were also able to illustrate architects' ideas with SketchUp and 3DSMax.

Following the rapid advance in construction technology, with support from the industry, the College had early approached to the concept of BIM (Building Information

Modeling) in 2012 in form of BIM seminars with the participation of Autodesk's experts. Numbers of seminars, training, technology transferring etc. concerning BIM tools training were implemented afterward.

## 2 BIM application (BIM Tools) integration process

Since 2015, BIM tools has been incrementally updated in the architectural technician curriculum, and gradually succeeding the existing training curriculum of the College. Initially, BIM tools have been step by step integrated into the syllabus through small-sized project, including Revit Architecture, Revit Structure, Revit MEP respectively. In that way, learners use BIM tools to implement the process of developing models in cyberspace. The structural components were developed corresponded to the LOD 200 [3].

After the Ministry of Construction issued Guidelines to apply the Building Information Modeling (BIM) [3], the training of BIM tools [2] [5] has been orientated to proceeding actual building, including construction projects of the College in the South Saigon and other projects such as social housing, offices, etc. are piloted for students to apply BIM experimentally. Creating models in local-central network system have assisted students to have experience when deploying BIM in architecture, structure, water and electricity systems; quantity calculation, detection of conflicts between disciplines, etc. Structural components were developed in line with LOD 300 [3].

The beginning results from the BIM tools training for the College are very positive, expressed through the rate of post-graduate employment, through changes in teaching and learning process.

Firstly, the high percentage of graduates with specialized jobs reflected the proportion of students getting jobs with positive assessments from businesses. The College has cooperated with 12 BIM consultants for placement. Through enterprise surveyed data, after finishing the internship, 88% of apprentices have the capacity to work immediately after the internship process. Furthermore, BIM modelers are straightforwardly able get jobs with income 1.5 times as high as the average income of existing technicians with CADD skill only.

Secondly, BIM tools had also positive implication on student. 88% of surveyed students using BIM tool (Revit) think that 3D models are visualized to insight understanding of projects structures. In addition, learners can develop themselves by changing their perception of learning, cooperation, personal responsibility in group activities; 85% of surveyed students said that learning BIM tool helps them to improve communicating, sharing and teamworking.

Thirdly, the application of BIM tools not only equips students with modeling skills, but also facilitates other subjects. Applying the architecture, structure and MEP disciplines of the BIM model vividly simulates and illustrates buildings, helps learners visualize the components of a house, the structure, pipeline layout etc., thereby supporting the statistics of volume of supplies and equipment.

### 3 Determining precise target groups

According to experts <sup>[7]</sup>, the positions of employees formed during the implementation of BIM such as BIM Modeler / technician (Model Builder); BIM Specialist / technologist; Coordinator (BIM Coordinator) and Manager (BIM Manager). Through needs survey in some partner companies, experts believe that in the four positions mentioned above, the need for the number of modeling specialists (BIM Modeler) at present is 60%, the highest rate in the process of model establishment and analysis. This position is also consistent with training at intermediate TVET level <sup>[7]</sup>.

A BIM Modeler is a technician who carries out responsibility of creating and updating BIM information models for different purposes such as produce design layouts, shops drawing, visualization, build 3D library etc. Modelers are specialized in one subject or multi-disciplinary modeling <sup>[7]</sup>. This target group requires quite similar skills, can be upgraded quickly from the content of training traditional technicians. Therefore, BIM Modeler is chosen as the main target groups of the College training courses.

The idea to develop competitive BIM modelers are now endorsed by a large number of

Experts and companies' managers who are day by day facing with the lack of technicians working in BIM models despite of a huge number of engineers graduated from university every year. However, the current national-level BIM pilot training programs in Vietnam are now focusing on group of universities without any significant engagement of TVET <sup>[2]</sup>.

### 4 Clearly identify new competencies in the curriculum

The description of BIM technician's position mainly requires core competencies and technical competencies <sup>[7]</sup>.

The core competencies consist of communication, cooperation among project members, ensuring collaboration between stakeholders, which are key factors for success. In order to work in BIM process successfully, learners must be initially trained to develop teamwork and collaboration skills such as communicating, transferring information and ideas, as well as improving the ability to utilize English. In addition, students are to be coached to actively learn, apply and share new knowledge and skills acquired at work.

The technical competencies demonstrate their professional ability to apply BIM successfully. The course can reduce some of the existing skills concerning CAD etc., only focus on the ability to use tools that create information models for each specific purpose such as developing component libraries; developing and testing information model; making animation, extracting build quantity from the model <sup>[7]</sup>.

The above competency groups are defined as the basic competency groups, suitable for intermediate level training course within 1,5 to 2 years duration. Furthermore, graduated learners are also enabled to obtain additional capabilities in the process of working and lifelong self-learning process.

## 5 "Classroom at enterprise" could be an effective solution.

According to experts the capacity to work with BIM can be developed in several conducts such as formal education, vocational training or job training (on-the-job training) and do professional work [6]. In fact, the BIM modeler training process at the College shows that the most important task is to create a learning environment that simulates the real working environment. In order to offer a skilled BIM modeler after a short period of 1,5 to 2 years, the course must provide students opportunity to practice in teamwork, working with authentic projects, simulating the process of project and information exchange [4]. This process effectively helps students to get direct access to the work environment after graduation

The combination of TVET and industry [4] is a key factor to strengthen the pedagogical capability of training institutions. Cooperation plan must be concretized by detailed implementing plans, that allows students to participate in practical projects at companies, helping students to strengthen their knowledge and skills learned at school. Before being guided to the enterprise, students' knowledge and skills are synthesized through a general project, helping students confidently work at the enterprise. During the internship, the business appoints experts to guide them the culture, processes and methods of doing business tasks in the enterprise. The College also engages teachers to support students in a two-month internship. At the end of internship, enterprises would comment, assess and mark points, participate in surveys and provide further suggestions.

In the next phase, the College are to conduct training courses with higher rate of industrial engagements. Learners should involve in placement at the commence to learn business culture and code of conduct, etc. OTJ (on the job training) process should increase toward 70% of training time under the form of placement where learners are guided by experienced technician to conduct real projects. More authentic document and practical building codes and standards related to BIM should be included in learning sources etc.

These activities aim at enhancing workforce of the business in process of creating BIM products also effectively support the comprehensive skills of the students to meet the demand of the industry.

## 6 Some challenges in implementing BIM tools training

The integration of BIM tools in training requires long-term, genuine investment with time and rational cost. In fact, the process brings out some barriers in strengthening teaching capacity; improve the IT system; and develop training curriculum that appropriates to the entry level of TVET students.

Regarding innovating teachers' capability, training courses were organized at the college and enterprises. However, only about 30% trained teachers are qualified, some of them have moved to businesses or universities. Visiting tutors from the industry have been invited, but training methods are also their barriers. This is resulted from the sluggish change in the perception of teachers to a new and unfamiliar issue.

Actually, teachers are working as consultants in their own businesses. However, the majority of their businesses are small and medium-sized enterprises which still apply the traditional methods; thus, BIM tools are found unnecessary for their job. Consequently, 65% of the opinions of the surveyed teachers believe that there are still very few businesses applying BIM. In reality, the application of BIM currently focuses on a number of large corporations and some companies specializing in model processing. Thus, it is still controversial about the popularity of BIM in reality, leading to a dilemma of changes.

Besides, in order to fully deploy BIM tools which are increasingly advanced, the existing IT system needs to be regularly upgraded and synchronized. The investment can only be taken by small steps, thus, supports from industries are highly appreciated. In addition, due to Government's education and training policy, the entry level qualification with post-secondary is an immense challenge for the College. 44% of surveyed students said that learning BIM tools application is more difficult than other applications; teachers also claim BIM tools for more of effort than other applications. It is due to the complexity of the interface, three-dimensional space cognition, teamwork skills etc.

In order to slowly clear these barriers, beside endless efforts of TVET, more supports from national BIM development programs are expected to stimulate the application of BIM in TVET of which changing mindset of stakeholders on the role of TVET and adequate resources for long-term cooperation between TVET and the construction industry are essential.

## 7 Conclusion

Building Information Modeling (BIM) <sup>[1]</sup> is increasingly widely used in construction operation and management. The development of BIM, therefore requires a large number of human resources with new job positions and new competencies compared to the previous technology.

The BIM applications incrementally applied in training have strong positive implication on both learners and teachers in TVET. It has changed the training methods, requiring early determination of positions learners would take charge of the enterprise with BIM application as target groups; requiring clear identification of new concreted competencies in the training content that straightforwardly enable learners to obtain successful career objectives in the fields of BIM.

Especially, the process also emphasizes the cooperation between businesses and schools as the most effective solution to provide competitive employees that could effectively utilizing BIM for construction industries. This is also to highly appreciate the commitments and willingness from BIM consultants to joint training program for BIM modelers.

This article also calls for further recognition and effective support TVET from the government's BIM development programs to clear the barriers in BIM modeler training. That is to say, the training of BIM modeler when being rationally analyzed in TVET, showing the necessity and effectiveness, affirming the role and position of the

TVET system in human resource development working within the field of building information modeling./.

## References:

1. Government, Approving the Scheme on application of construction information model (BIM) in construction and management of project operation, 2500 / QD-TTg, (2016).
2. Ministry of Construction, Announcing the program of training and retraining framework applying Building Information Model (BIM) in the pilot phase, 1056 / QD-BXD, (2017).
3. Ministry of Construction, Announcing the guidelines for temporary application of Building Information Model (BIM) in the pilot phase, 1057 / QD-BXD, (2017).
4. References to train source lecturers on BIM at Hanoi University of Construction in 1/2018.
5. Nguyen Bao Ngoc, Nguyen The Quan, "Frame Bim training program for building practices: patterns and recommendations", Journal of Construction Economics (ISSN 1859-4921) No.02/2018. (2018)
6. B, Succar and W, Sher, "A competency knowledge-base for BIM learning", Australasian journal of construction economics and building - Conference series Vol. 2 No. 2 (2014)
7. Nguyen Nhu Trang, "Building capacity to work with BIM in vietnam", Journal of Construction Science and Technology No. 01-2018 (2018).