BIM EDUCATION FOR NEW CAREER OPTIONS: AN INITIAL INVESTIGATION

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ABSTRACT

Current efforts in promoting college BIM education tend to focus on curriculum development and student learning outcome assessment, among which the Architecture, Engineering and Construction (AEC) industry has been playing an indispensable role. As acknowledged by both the academia and the professional community, college education is critical for quickening the learning curve and recruiting ready-made BIM professionals for the industry. It seems that there is a gap between the industry expectations and the student learning outcomes, which is directly reflected by the fact that companies seldom recruit college students for job openings dedicated to BIM. This research utilized a comparative survey that invited stakeholders from both communities to investigate the possible impacts of BIM education on students' career development, and how current recruiting practices may help identify discrepancies between existing BIM curriculum development and industry expectations. Results of this research are expected to facilitate rethinking and enhancing collaboration between educational and professional communities on promoting a career oriented BIM education.

Keywords: BIM education, BIM curriculum, career development, recruiting, comparative analysis

1. INTRODUCTION

Bureau of Labor Statistics (BLS) reported that the most recent unemployment rate (August 2012) in the construction industry had seen encouraging improvement yet remaining 3.2% higher than the national average (BLS 2012a, BLS 2012b). This competitive job market is especially challenging to graduating college students who are looking for the first-ever job. To aggravate the situation, the overall Architecture, Engineering, and Construction (AEC) industry has also been undergoing unprecedented transitions to address imperatives in improving business efficiency and profitability due to the more stringent budgets and higher expectations from owners and developers. Reflected in talent acquisition strategies, AEC companies now are looking for recruiting candidates with new skillsets that fit into the needs of such transitions. From the students’ perspective, it implies that the conventional wisdom on how to secure a job may no longer apply. A most unambiguous transition undergoing is the rapid adoption of building information modeling (BIM) sweeping across the global AEC industry. Promptly, the educators have responded to it via integrating BIM as part of the curricula, creating course contents and experimenting BIM pedagogic approaches. The industry professionals on the other hand are busy dealing with human resources and organizational development challenges as it relates to understanding the need for BIM talent, finding it and then placing employees properly within the existing system (Joseph 2011). It will be of interests to both the educational and professional communities to look at the synergies between college BIM education and a job market featuring BIM talent acquisition, to facilitate learning from each other for the sake of better understanding the issues they are currently facing, and to seek after possible solutions to more efficient and effective BIM education and staffing in general.
2. BACKGROUND

The underlying supply-demand relationship between universities and the industry has been more reliant on students’ intellectual (Bilbo et al 2000) and technical (Barison and Santos 2010a) readiness, especially in the case of BIM. Therefore, the effective inclusion of BIM into college curriculum has become both a pedagogic and practical imperative in preparing future employees for the AEC industry (McGraw-Hill 2009; Crumpton and Miller 2008). Use and adoption of BIM in the AEC industry is hindered by the lack of adequately trained BIM personnel (Becerik et al 2011). BIM education is considered as a solution to quicken the BIM learning curve thus companies can recruit ready-made BIM experts when the students graduate (McGraw-Hill 2008). In spite of the fact that BIM education has undergone significant transformation and improvement (Barison and Santos 2010b), scholars have been criticizing educational institutions for their lack of strategies and capabilities to effectively introduce and leverage BIM into existing or future coursework (Sabongi and Arch 2009, Clevenger et al 2010), and many academic programs are struggling to meet industry and student expectations (Clevenger and Rush 2011). Up to date, efforts in BIM education have fallen into two major categories:

1. Leveraging BIM as an interruptive technology: In this scenario, there is no dedicated BIM course created necessarily but rather BIM contents and tools are introduced in traditional courses.
2. Establishing BIM as a new paradigm: In this scenario, BIM goes beyond a “facilitator” role but become a center piece in a transformed curriculum and pedagogical strategy.

BIM is highly practical, which makes it meaningful, if not necessary, to seek inputs from industrial experts in curriculum development and actual course instruction. The value of partnership between the AEC industry and research community has long been cherished (Tener 1996, Bakens 1997, Becerik et al 2011, Clevenger and Rush 2011). Nevertheless, there is very little literature on: 1) how BIM education might impact students’ career development; and 2) how current recruiting practices in companies might affect the selection of the forms and contents of college BIM curricula. This is intriguing since universities and the professional community both have recognized the nontrivial gap between students’ skill set and workforce expectation from employers in the AEC industry, aggravated by the anticipated shortage of capable BIM-oriented professionals over the next 20 years (Smith and Tardif 2009). Student job placement might not be the only goal of college education but the leverage that BIM might provide to improve students learning outcomes and to enhance their career development and industry recruiting satisfaction seems to be of interest to stakeholders from both sides.

This research is intended to investigate perspectives and experiences of educational and professional communities on BIM education, career development and recruiting, using a carefully designed dual-track survey. A comparative approach was undertaken to evaluate college BIM education against employers’ expectation based on a simple supply-demand correlation. It was the objective of this research to bring industry professionals an opportunity to convey a clearer message on what employees they would like to recruit for BIM, and to help educators rethink the priorities and best practices in existing BIM education development. The goal of this research was to collect the data that would allow for a more comprehensive and productive conversation between educators and professionals on advancing BIM education and implementation.

3. METHODOLOGY

This research used an online survey to collect desirable data. Online or web based surveys have become a preferred approach in the research community as well as the business world due to their advantages, such as low cost, ease of deployment, flexibility, speed and timeliness, over traditional surveying methods (Evans and Mathur 2005). Nevertheless, there are also concerns regarding the use of online surveys. A biggest threat to the credibility of online survey results is the coverage error, which is the mismatch between the target population and the frame population. Sampling error can also be significant, which arises from the fact that not all members of the frame population are measured (Couper 2000). Low response rate is another potential pitfall of online surveys (Evans and Mathur 2005).

For this research, two distinct sampling populations were used: 1) the educational community, consisting of faculty majorly affiliated with the Associate Schools of Construction (ASC, hereinafter referred to as P1); and 2) the professional community in the AEC industry (hereinafter referred to as P2). The survey started with general
demographics questions. P1 and P2 were then directed to separate subsets of questions catering to the respondents’ background and expertise. These questions were comparable in contents and were intended to probe for distinctive perspectives on similar issues within contexts of the two populations. The survey was constructed in Zoomerang (http://www.zoomerang.com), which is a leading online survey service provider. To reach the target population, the email listserv of the Associated Schools of Construction (ASC) and buildingSMART alliance were used. In addition, the survey link was also posted to BIM relevant professional groups at Linkedin (http://www.linkedin.com), which is the world’s largest professional social network. Major limitations of the sampling method used in this survey might include insufficient coverage of sampling and redundant information due to the fact that faculty from the same university may take the survey. Nevertheless, impacts of these limitations were alleviated by the fact that: 1) the purpose of the study was to provide insight into activities relative to college BIM education and AEC industry recruiting trends rather than providing a generalization of the population (Israel 2009); 2) the participants solicitation used was an example of non-probability sampling since there was no established sampling frame or list of members of the accessible population (Gliner et al 2009); and 3) only descriptive statistics were used in analysis of the survey responses (Johnson and Gunderson 2009, Becerik et al 2011, Gunderson and Gloeckner 2011).

4. RESULTS AND ANALYSIS

The survey was open for a total of four months, with 728 visits and 120 completed questionnaires. There were also 93 partials and 26 screen-outs due to the lack of relevant information or experience needed by the respondents to complete the survey. Out of the 120 completed questionnaires, 46 (38%) were P1 respondents and 74 (62%) were from P2. Associate professors (30%) from construction management programs (87%) were predominant representatives in the educational community, while top management personnel (35%) with architectural firms (41%) were leading in the professional community. Geographically, the respondents had a nice overall distribution across the country. The majority (59%) of the academic programs had 200 people or fewer. The companies were either very small (43% with up to 50 people) or gigantic (36% with more than 500 people).

4.1 BIM Uptake Status

Adoption of BIM was the first issue this survey examined. Academic programs and companies that had not yet integrated BIM in their daily operations at the time of the survey were screened out due to the fact that no valid data could be obtained from them in ensuing questions. Current literature shows broad adoption of BIM in both academia and the industry. Results of this survey confirmed this conclusion, with industry slightly taking the leadership (Figure 1).

In academia, the word “integration” was defined as unambiguous evidence of BIM uptake in curriculum development. According to this survey, Bachelors programs had the best exposure to BIM (87%), followed by Masters (20%), and 7% of the programs had full coverage including PhD programs. Associate programs were also
on board (7%). The degree of BIM integration varied, but dedicated BIM courses (54%) and BIM-embedded conventional courses (52%) were among the most popular approaches (Figure 2), as anticipated based on the literature review findings. Each program had distinct priorities in topics and contents covered by their BIM curriculum (Figure 3), with software applications remaining as a major focus. Overall, educators rated current BIM integration level in academic programs as “Moderate” (50%).

On the non-academic side, the number of annual awarded BIM projects and percentage of annual income attributed to BIM-related business were the two major indices used for measuring BIM uptake status in the AEC industry, which suggested a sturdy growth (Figure 4a, 4b). More than a third (36%) of the participating companies were awarded 20 or more BIM projects in fiscal year 2010-2011. BIM also contributed to more than 80% of annual income in nearly a third (27%) of the participating companies. When asked to outlook the growth of BIM business development, as many as 73% of the respondents showed confidence in significant increase in a 5-year forecast. Overall, BIM business was rated as “Very Important” (59%) to these companies’ strategic development.

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4.2 Career Development and Staffing of BIM

This survey, arguably for the first time, proposed a direct interconnection between BIM education and students’ career options as a result of an emerging trend – BIM staffing – in the industry. Unfortunately, the BIM oriented career development was a quite recent concept to the educational community that only 2% of P1 respondents had kept a more-than-5-year track of history on employment opportunities specifically attributed to BIM education. Although considerable P1 respondents (41%) believed that promoting BIM education had “High” impact on the overall reputation of their academic programs, 39% of them admitted that there were no incentives in place in their programs to encourage students taking on a BIM oriented career path (Figure 5). However, the commitment
to change the status quo was quite apparent as shown in the survey that most of the participating academic programs had been recruiting faculty dedicated to BIM teaching and research, at both ranks of “Assistant Professors” (41%) and “Instructors” (39%). The survey also suggested that “Personal Interest” was a leading factor that contributing to students’ selection of BIM as their career, followed by “BIM recruiting/intern/co-op” and “BIM education” (Figure 6). As an outlook, more than half (52%) of the P1 respondents expected the BIM related job market to increase significantly in a 5-year forecast.

BIM staffing in AEC companies referred to hiring to fill positions demanding BIM expertise. Issues to be addressed included defining BIM job titles, the availability of BIM job openings, and the forecast of the BIM job market. According to this survey, “BIM manager”, “BIM coordinator” and “BIM modeler” were the top 3 BIM job titles identified by both P1 and P2 respondents (Figure 7). A noteworthy finding from the comments on this question was that quite a few industrial professionals criticized the use of “BIM” in job titles for being misleading. In their opinions, BIM was an overall integrated business process and should not be isolated to specific job titles. Nevertheless, it is still popular in the industry to use the “BIM” prefix in job advertisement. Most companies (86%) had dedicated BIM positions, while the majority of them (49%) had less than 5 employees occupying these positions. “BIM department” was another “buzz” term, and to some degree it reflected a company’s strategy of investing in BIM. There were 61% of P2 respondents who claimed the existence of BIM departments in their companies, but only 23% had a BIM department with more than 5 employees. Companies were also quite careful about budgeting for BIM staffing, while the overall market demand for BIM professionals was expected to have steady growth (Figure 8) as the same did by P1 respondents.
4.3 Gaps and Opportunities in College BIM Recruiting

College recruiting is critical to talent acquisition in AEC companies. Most companies have dedicated personnel and budget for various recruiting events such as on-campus interviews, internships, co-ops, and so on. In the case of recruiting for BIM positions, companies did not show substantial reliance on colleges yet. Less than 30% of the surveyed companies considered college students (undergraduate, graduate and doctoral) in their BIM staffing. Instead, they preferred to hire seasoned professionals with 1-3 years of experience (45%) or to cultivate internal employees through organizational training (49%). As a matter of fact, as many as 73% of surveyed companies did not have any BIM recruiting programs with colleges in place, which explained that fact that the ratio of college students in BIM dedicated positions was relatively insignificant (less than 5%) in these companies.

These results exposed an inconvenient fact that there was an ignorable gap between college BIM education and the expectations in the industry. Especially when BIM education was believed to enhance students’ competitiveness in the job market and was deemed important to prepare qualified candidates for staffing BIM positions in the industry, which was verified in this survey as well as shown in the literature. With these questions in mind, the survey found out, actually with little surprise, that the biggest debate between the educators and professionals was regarding the perceived effectiveness of current college BIM education in preparing students for a BIM career (Figure 9). In particular, industrial professionals cited the major defects in current BIM education to be “lack of understanding of multidisciplinary model management” and “lack of relevant BIM project experience” (Figure 10). A close look at these charges against the education community made the problem actually more complex. The educational community could make a legitimate argument that in the academic settings, it was challenging to create a multidisciplinary environment with usage of real BIM projects to give students the opportunity practicing “model management”. Academic departments and units by far were not as nearly collaborative as it should be, compared with the mandatory collaboration required in a project team. Besides, who actually deserved the criticism when it was about “lack of relevant BIM project experience”? At least the educational community has always recognized and appreciated industry participation in academic teaching and research.

![Figure 9: Satisfaction level of college BIM education.](image)

![Figure 10: Defects in college BIM education identified by industry.](image)

That being said, it would require consensus and endeavors from both communities to improve the situation. The survey found it encouraging that educators and professionals actually shared common opinions on priorities in future BIM education for college students (Figures 11 and 12). They also agreed upon the fact that enhanced collaboration and partnership in various forms should take place before any significant accomplishments could be made in the field of BIM education and recruiting in college programs. Examples of possible activities include direct pedagogic input of industry BIM experts, knowledge sharing through conferences or workshops between educators and professionals, set up formal BIM recruiting programs such as internships and co-ops, and so on.
CONCLUSIONS AND FUTURE WORK

This research was an initiative to look at the dynamics between BIM education and BIM oriented career development. Through the lens of both the educational and professional communities, a more complete picture of the issues under investigation was attained. The survey confirmed that the uptake of BIM had made substantial gains in both the education and business arenas. Curriculum coverage of BIM had significantly improved and a stronger BIM market had created an impetus for more effective and efficient recruiting. Up until when the survey was conducted, BIM oriented career development was still novel to most academic programs with little or no existing track record. Companies preferred to hire seasoned professionals instead of fresh college graduates in BIM staffing. Their college recruiting programs had not established any firm priorities to BIM dedicated positions yet. Nevertheless, the rising market demand for competent BIM professionals would eventually force companies to adjust their recruiting practices through enhanced and more proactive collaboration with BIM educators. To accomplish this goal, the results of the survey suggested the following critical steps to be taken via an academia-industry partnership:

- Continue to improve college BIM curriculum with more direct input of established BIM professionals to bridge the gaps between theory and empirical experience;
- Define clearly the specificity of the BIM oriented career path and the expectations of college BIM education learning outcomes;
- Create tangible incentives to attract and foster students committing to the BIM oriented career path;
- Devote and/or enhance desired resources in college BIM recruiting;
- Establish and maintain standard, traceable statistics in BIM job placement records.

This survey was appreciated by most participants for initiating a conversation that was very much needed. Noticeably, this survey also inspired a quite philosophical discussion over whether “BIM specialist” or “BIM generalist” was more desirable to the AEC industry. There was a good understanding among the respondents that BIM was aiming at providing a collaborative, interoperable and integrated solution to a highly specialized and fragmented industry. But when it came to an individual’s career development, what skill set or body of knowledge could make one more competitive than the other? Should college BIM education train students to be more versatile instead of dedicated or the opposite? Should BIM education be more general/introductory or more specialized and in-depth? Educators participating in the survey argued that it would be up to the discipline, the specificity of job roles, and availability of instructional resources, and to name a few. Yet, this remains an interesting and on-going question to be investigated in future research. Ensuing research will look at the qualitative impacts of companies’ recruiting practice on BIM curriculum development in AEC educational programs, and also examine specific qualifications for various dedicated BIM positions.
REFERENCES


