BIM DESIGN COLLABORATION REPORT

In student’s perspective

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Abstract. The discourse to mould Building Information Modelling (BIM) into the early architecture education has been escalated in many scholar papers and discussions. Scenarios are made to obtain optimum educational deliverance. However, the response from students’ perspective to the outlined subject has not been reviewed in terms of their competences, especially in Indonesian higher education where architectural computing education is relatively new. After BIM is delivered in two semesters span in the early stages at Bina Nusantara University, Faculty of Engineering, Architecture Department, survey is conducted to depict their understanding. This article is the feedback report, which shows that the students were self-convinced to the potential of BIM and its future. In achieving that particular level, the combination of various delivery methods is the utmost strategy to accompany the design studio with BIM.

Keywords. BIM; collaboration; role-play; education.

1. Introduction
Since 2010, the Architecture Department in Bina Nusantara University (BINUS) has probed the curriculum by taking chance to embrace BIM. The urge of BIM implementation was based on providing the students with the ability to utilise the tools, while introduce them with the professional design process. Initially, the students were introduced to design and drafting with traditional CAD on the second semester. Then BIM Introduction course started on the third semester of all eight semesters that students should take. On the following semester, they were opted with the interest group subjects which one of them is BIM Design Collaboration.
The course outlines were designed to obtain optimum educational delivery. One of the ways to evaluate the learning outcomes is by designing an assignment that contest their ability, where undergraduate students in an architectural curriculum may be assessed on their ability to provide solutions to a design problem, involving computer as the tool. Therefore, BINUS should now comprise the pedagogical transition from traditional abstraction to BIM (Ambrose, 2012) (Ambrose & Fry, 2012).

Conversely, the students’ standpoint entails consideration to optimise the course outline in terms of their awareness and competence. This action is necessary, as architectural computing education in Indonesia does not have such precursor realm. Computer merely becomes an option to replace pencil and paper in their design process. This article provides an overview of the assessed curriculum from students’ perspective related to their past experiences of traditional design studio.

2. The survey background

In the early semesters, BINUS students had learnt the basic architectural knowledge and design, including structures and building services for middle rise building with mixed use. The architectural computing comes as a supportive course rather than an embedded tool inside design studio. Therefore, this course stands as a secondary studio format where it is trying to implement computer in the design process.

Respectively, architectural computing started on the second semester with AutoCAD for design and drafting for 120 students, followed by BIM introduction with the same students on the next semester. Then 32 students decided to focus on computational design as their interest. Afterwards, BIM course was advanced to engage design collaboration. The decision to introduce the virtues of BIM in the third semester was made by predictive judgement that students had the competence to apply and elaborate design consciences with the different approaches. The advance course used ArchiCAD 16 with teamwork feature to enable design collaboration with BIM Server. Eventually, survey was conducted to depict their understanding by the end of that semester.

The samples of this survey were the students who took the collaboration class. There were two types of questionnaires given to the students, open and closed questions. Both of them had correlated topics regarding the process they learnt. Thus, the answers could be analysed quantitatively and qualitatively. The open questionnaire started the survey, and then followed by the closed questionnaire. The closed questionnaire is a 1 to 10 scaled query,
where 10 indicate the highest stake. This report discussion also includes the observation and events on the classroom.

3. Results and discussion

The focus of this survey is to depict experience of design and its process using BIM that most of the curriculum should embrace (Boeykens, De Somer, Klein, & Saey, 2013). Hence, the observed topics were surveying about Roles, BIM Modelling, Design Process and Design Collaboration. Follows are the further discussion.

3.1. ROLES

There were 8 roles delegated to 4 teams that consisted of 8 members. Their respective roles are: BIM manager, chief architect, interior designer, landscape architect, structural engineer, mechanical engineer, electrical engineer and plumbing engineer. They were collaborated to design a three storeys office building in different sites.

From the open questionnaire, the first question asked about how they describe their role. Majority of the students described their roles theoretically and some of them were able to give an example of what they were doing. Although, there were no descriptions related to the tools, BIM. In this stage, students are still engage with the conventional understanding of the design process (Clayton, Ozener, Haliburton, & Farias, 2010).

When the student rated their consideration about their role, averagely the rate was high as shown in Figure 1. The lowest score they gave was above the middle scale, which stated in electrical engineer and mechanical engineer roles. Moreover, they stated that they were lack of knowledge regarding the implementation of those particular engineering. What they knew was just a schematic notion of the building systems.

As a contrast, Figure 1 shows the plumbing engineers had a highest rate and the chief architects role followed it. From the discussion in the classroom with the plumbing engineers, they found the 3D exploration brought visual enrichments to their understanding especially in sanitary. The chief architect, who had the advantages of taught knowledge in the curriculum, was preoccupied with the confrontations of their overwhelming design problems since the beginning. They wrote in the open questionnaire that this was a process they never had before and the frictions raised the frustration they faced. They were expected to determine some decisions that affected other roles.
From the Role Understanding versus the Possession of Required Skills, it is stated that the student already knew the theories but there is still anxiety of how they applied the knowledge using BIM through the design process.

3.2. BIM MODELLING

Being introduced to BIM on the previous semester brought the collaboration focus more on the design. Nevertheless, the challenges in BIM modelling were still occurred. In this second part, the questionnaires try to evaluate how the students interact with the tools to model their design. The result on Figure 2 shows that the students faced some difficulties on utilising the tools. However the overall students stated that they believed the contribution they have made to the team’s goal could never been greater.

The biggest challenges in modelling appear on the mechanical, electrical and plumbing tools (MEP). All of the students utilised them for the first time and 80% stated that they had to learn from many sources independently while the mentors helped the others. They said, this added the burden in the
design process. Moreover, they were assigned to research the necessity of the building services.

The fact is that they are still learning on some Technical Skills Competencies and Architectural Design Competencies, fundamental subjects. This background made the students easily fallen into short views of the design problems. Many of them were too concentrated on the details but blurred on the bigger picture. On that stage, the guidance from the mentor or the professional is needed to broaden their point of view. The firm architectural knowledge and skilful expertise in architectural computing may smoothen the process (Haliburton, Clayton, Ozener, Farias, & Jeong, 2011) and the students should be directed into that point. To reach that aim, the curriculum are supposed to thrive the ecosystem by plotting the exercises through the course.

3.3. DESIGN PROCESS

Design process was emphasised as a core-structure on the two semesters BIM classes. The students were guided through the Project-Based Learning in those processes; consequently the learning process to the computing skill was extracurricular.

The third survey was questioned about the students’ management ability through the confrontations they had experienced. The average rate on Figure 3 stated 7 out of 10 to scale the difficulties level in the design process. The most challenge emerged in the chief architects side, while the lowest founded on the landscape architects role. The open questionnaire indicated that architects had trouble in establishing the ideas of the other divisions. On contrary, the landscape architects role had less challenges because they worked with fewer stakeholders such architect, electrical and plumbing engineer.

![Figure 3. Design process closed questionnaires result.](image-url)
In terms of problems confrontation, quantitatively the result shows the chief architects role is still dominating. Some students expressed that the tool was too rigid to accommodate their design ideas. An exponential learning curve became a mountain to climb after the design problems which student faced.

Tacit knowledge as Clayton et al (2010) discussed is a circumstances for academia to cater in the design collaboration. Agreed to what they said, the intensive approach on every design stages was one of the desired learning processes here. Professionals’ point of view would be a distinct contribution to this concern. A little research and design reports were assigned to enrich the process, including the role-play in this design collaboration. Subsequently, the delivery method needs more than lecturing and tutorials.

3.4. DESIGN COLLABORATION

The last observed aspect is the design collaboration. Students were asked about their effort such as how they solved the design issues in teamwork; what did they think about the collaboration process with BIM; and how did they predict the future of this design technology.

There were numerous technical obstacles obstructed the process. The students felt that these bottlenecks need some developments. Although they were struggling in the team, they still discussed their founds to other groups. This atmosphere accelerated the problem solving process. One of the annoying problem was the classroom computers and the server, they were set with a deep freeze application which prevent data storing permanently on the system as this is a University’s policy. On every class sessions, they had to spend time to store the data to the server and then saved them manually in the end of the class. Therefore the IT administrator was involved in the process to tackle the technical problems. Also the vendor representative, who is a professional architect as well, was invited to help the collaboration.

There were hopes and expectations in students’ comments that next the University could give flexibility to the system policy and access to the online server. Hence, they could really work collaboratively, inside and outside the classroom.

In Figure 4, almost all participants believed what they did were valuable for their future career. Although they were pessimistic about the results, which they thought, it did not meet the professional standards. They are promised them self to be better in the next project after the project review. More on the qualitative survey, students expressed their enthusiastic involvement in this programme, while there were many things to be noted along the journey.
3.5. SURVEY RESULTS

The student’s awareness regarding the courses was relatively decent as they uttered more on positive sentiments. Despite they bear such high workloads, they managed to pass many challenges occurred in reaching the project accomplishment. They admit that this course was their distinction effort which they never done it before on other courses, even the main design studio.

Figure 4. Collaboration design rate feedbacks.

To summarise the closed survey, the overall rate of 10 questions shows on Figure 5 that the students were positioning themselves above the mid-range. It is expressed that they were self-convinced to the potential of BIM and its future. Although they knew so much need to be worked out in their assignment showed in Figure 6. Equipped with three semesters of architectural design computing, the students’ understanding and readiness had reached the phase that they were assertive of BIM virtues, which would help them through the design process.

Figure 5. Overall rating of conducted surveys.
4. Summary

It is clear that the power of visualisation becomes an effective entry point to direct the student intuition in the design process although they were trapped in to its limitation most of the time. The 3D object gives a two ways of comprehension to the students whereas they knew the theory but never recognised the form before and vice versa. This case mostly happened in MEP engineer roles. A limited BIM object library was the other aspect that needs to be developed from students’ outlook.

The lesson learnt from this survey is obvious that all corresponding courses had to work together to link the shift of the quality information. BIM visualisation could enrich courses like *Structures & Construction, Building Systems, Interior Design* and *Site Analysis*. Reciprocally, this could change the way in which courses are delivered, by utilising the tools. Lecturing merely would not consider as an effective delivery method anymore. The action might resolve the condensed outlines in such limited timeframe. Am-
brose and Fry (2012) have pointed out that there should be a breakthrough in this delivery strategy, and Boeykens et al (2013) presented that the course should give experiences of good design process as well as good product outputs.

Combining various delivery methods is the utmost strategy to accompany the design studio with BIM, whereas this conclusion would affect the next course outline development. Preparing the academia awareness about the technology is another step to develop in the department to achieve the curriculum synergy. The preparation would involve the professionals and vendors contribution.

Acknowledgements

Gatot Suharjanto, Herdy Nurpatria, Melania Wiannastiti, Firza Sjarifudin and the Bina Nusantara University – Architectural Design Computing students, supported the report presented in this paper.

References


