

The Unbearable Lightness of BIM

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In this paper we investigate the current state of BIM usage in Czech Republic and aim to find strategies how to improve BIM education based on findings from practice. We give an outline of the current state, identify problems that provide hurdles for BIM adoption, and show how we implement a new pedagogical approach to BIM education in our faculty.

Keywords: BIM, academic BIM, practising BIM

INTRODUCTION

In order to systematically monitor the education of CAAD at our institution, we have developed a framework for measuring four aspects related to teaching (Matějovská and Achten 2011):

- Student's entrance level skills in computer/-CAD use.
- CAAD skills of students during their studies.
- Exit skills and expectations of students.
- Enquiry of practitioners.

In this paper we focus in particular on the last aspect (enquiry of practitioners). Building Information Modelling (BIM) is widely conceived both in academia and practice as a very promising set of technologies, processes, and methods for CAAD. In our country, BIM adaptation is at a very low rate and in fact there are only a few firms actively investing in this despite a general wide awareness of BIM's existence. For an educational situation this creates a situation in which we have to balance a number of seemingly contradictory requirements:

- Train students to have the necessary skills so they can be employed when exiting the school.
- Train students to have the knowledge and skills to understand and learn new technologies (which currently are not used in practice).
- Teach practical and theoretical knowledge under a tight pedagogical time schedule that competes with many other subject matters.

Because of this, we turn to practice for two reasons - one, to get a realistic impression what recently graduated students will actually do in practice; and two, to educate practice in order to advance the application of contemporary (and near future) CAAD technology. On the basis of these findings we hope to establish a pedagogical approach that is both grounded on practice and offers students best potential on the market after finishing school.

BIM - OBSERVATION STRATEGY

To obtain a clear overview of the current state of BIM application in practice we went about in the following way. First, we set up a workshop for practitioners about BIM. Through this workshop we got in touch

with many early adopters and architects interested in using BIM, and became acquainted with contemporary issues in the use of BIM in practice. Based on this experience, we created an inquiry in which we investigate in more detail the current state of BIM in practice. In particular, this enquiry dealt with the following questions:

1. In what type of projects is BIM applied?
2. What is the role division of people engaged with BIM in such projects?
3. What deficiencies and problems are currently experienced with the use of BIM?
4. What are the currently perceived requirements for graduated students from practice?

Each question was subdivided into more specific sub-questions. From the enquiry we selected a number of companies which we visited personally for more detailed discussion. From these meetings we derived a deeper developed insight of current needs in practice. This is outlined in the following section.



BIM - STATE OF THE ART IN THE CZECH REPUBLIC

In Czech Republic the first firms started with BIM in 2003. The concept of BIM was mainly introduced by the marketing of Autodesk's Revit. In the wake of this, general interest in 3D modelling increased as well as other software such as ArchiCAD as a BIM tool. Due

to pricing policy the most noticeable spread occurred in 2005 when also small architecture firms (up to 5 people) could afford to buy BIM-oriented solutions. The only reliable data we can get is from the software dealers and resellers, but this obviously does not indicate anything about the real(istic) use of BIM software. Our own investigation in 2014 covered firms in Prague, Brno and surroundings - so only the tip of the iceberg.

We found that BIM adaptation is at a very low rate, and also were able to identify a number of hurdles. The crisis has put heavy pressure on the prices, in fact so high that offices have to work under officially stated fees. This obstructs investment in new technologies. In the current system, the production of project documentation is split up in multiple phases. For each phase a separate bidding round is made who actually produces the documents. There are no regulations governing the information structure of the documentation. Also, if an office does not continue in the next phase with a project, they are not likely to invest in BIM. Legally, all documentation has to be delivered in 2D.

Firms that are using BIM notice higher workload of about 10-20%. Therefore they need to acquire jobs that are more profitable in order to cover the additional cost. The only offices that are actually using BIM are those that are capable to cover all phases of the project documentation - therefore the large firms only. They find competitive advantage in the use of BIM. In many cases they are internationally oriented and see the benefits of BIM in their projects in countries such as Russia, China, Kuwait, and Saudi Arabia to name a few. Unfortunately, these offices are not keen to share their experiences, and therefore in Czech Republic do not figure as BIM role models for others. We found that offices which do make the transfer to BIM, stick to this methodology - they do not revert back to the old ways.

We found that a key role for BIM adaption is played by the project developers. They have a central role in that they formulate requirements for all other parties in the design process, and in this

Figure 1
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way push BIM acceptance. However, the absence of model contracts seriously limits BIM acceptance in this group. To our knowledge there are only about four developers (market leaders or young early adopters) that systematically use BIM. Because there is yet no completed project (they are all in design phase or still under construction) there are no exemplary projects that will show others how to use BIM successfully.

Czech norms and standards have not been implemented yet in BIM. The first act of the Czech Office for Standards, Metrology and Testing (ÚNMZ) was to adopt basic ISO norms, however in English - therefore Czech definition of terms are lacking. There are no agreed upon data definitions nor libraries from product supplies. In every new project an ad-hoc model is created which is immediately abandoned after the project. At the moment it does not seem likely that in the near future any coordination from a state organ can be expected. The professional associations ČKAIT (Czech Chamber of Authorized Engineers and Technicians Active in Construction) and ČKA (Czech Chamber of Architects) are not active in BIM at all.

Finally we can observe that the successful implementation of BIM is not just a question of getting the right software. BIM requires commitments from the users; they have to understand what they are doing, be able to create and manage multiple object libraries, and teach their peers and colleagues on the way as well. In the current Czech market this role of BIM-manager is fulfilled by external advisors or brave CAD/IT-managers. Here we see the greatest gap in our education, because none of our current graduates are sufficiently trained to fulfill the role of BIM-manager in practice.

Concerning the other parties in the design process, the installations and HVAC experts for the most part are external firms. At the highest level they produce 3D models, but the automatic calculation in Revit MEP is used rarely. BIM is used mostly for collision detection and optimising layouts between parties. Structural engineers in Czech Republic use their own software and models, in particular SCIA (Allplan

Nemetschek), which they convert from BIM models. Facility Managers at the moment only specify which information is of their concern. Budgeteers do not use BIM models at all, mainly because of the highly fragmented way budgets are calculated which is incompatible with the BIM database. Economists and certifiers do not use BIM at all.

As can be seen from the above, the low rate of BIM-adaptation is not caused by technological problems: affordable BIM-enabled software has been around since 2005. The main reasons are a complex mix of missing local norms, lacking government involvement, highly fragmented feeing structure, and lack of BIM-managers in the offices.

Table 1 gives the results of our 2014 survey. From this we can conclude that the reasons for not adapting BIM are the same as in practice, namely unwillingness to change thinking and change established practices.

PEDAGOGICAL IMPLEMENTATION OF BIM

Feeding these experiences back into education is not a straightforward translation of practice needs into CAAD teaching. Nevertheless, understanding what is currently perceived in practice as problematic allows us to better judge the relative importance of issues in CAAD education. Concerning education, from our investigation above we can see that our main role has two aspects:

1. Making our students knowledgeable about BIM.
2. Educate a portion of our students to become BIM-managers.

Only by systematically educating our students in the principles of BIM can the market start to appreciate the proper use of BIM and start to apply it in practice. A general understanding of BIM however is not enough - we also need people who from the start can implement BIM in practice - the BIM manager.

Recently we acquired a European grant to support BIM education in the design studio of the Bachelor degree. A design studio was initiated in which BIM

Level of adaptation of BIM - Prague, Brno and surroundings (design studios with BIM software)	
3D model, 2D documentation	80%
3D model + MEP	40%
3D model + MEP + structural engineer + model sharing	15%

Practising BIM - reasons for not adopting BIM	
unwillingness for changes (habits, thinking, content of work, work processes...)	42%
non defined BIM norms, definition of terms, contracts, content	18%
norms for drawings - libraries from product supplies, norms for budgeteers	10%
non existing positions for BIM (BIM manager, structural engineer, HVAC, instalations)	20%
price SW, price HW, low fee	10%

Students	
number of students in 2nd year - course CAD 3 and CAD 4 (Rhino, Blender, 3D max, Revit BIM, ArchiCad BIM, scripting BIM..)	250
students who study BIM software	
students who use BIM 1.0 in courses CAD 3 and CAD 4	65%
students who use BIM 1.0 in CAD 3 and CAD 4	40%

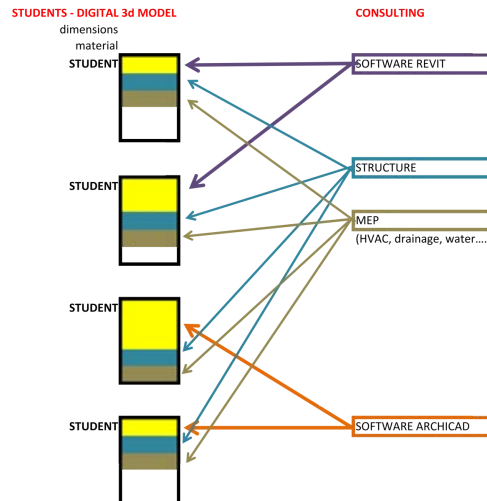
Students in 3rd year (Bc) and Ms students	
students who use only 2D software	50%
students who use BIM software in CAD courses, but in bachelor project no BIM, just 2D	50%
students who use BIM software in bachelor project throughout	5%

Reasons	
not required in design studios	95%
in design studios reject documents generated from BIM, only accept sketches or 2D drawings	40%
in design studios 3D software is not tolerated	20%

Table 1
Level of BIM adaptation in practice and schools of architecture in Czech Republic - limited survey.

was used throughout the whole design process. 19 Students participated in this design studio in the past two semesters (study year 2013-2014). Throughout the semester we organized workshops with experts from practice and PhD students from the Faculty of Civil Engineering. The experts consulted the projects, using the BIM model as a means of communication. We noticed that the students invested more time in the design studio than those in regular studios. They were able to create comprehensive 3D models with dimensional and material data. The BIM-model facilitated their understanding of the design process, construction, and to a small extent also improved their functional understanding of the building.

Figure 2
Setup of the BIM-dedicated studio: each student has a BIM-model (Revit or Archicad), with dimensions, materials, and installations defined (left column). This is used for consultation with experts external to the design studio (right column).



Building on these experiences, we initiate in the new study year 2014-2015 an all-BIM trajectory for the complete Bachelor program in which we will enroll a selection of first year students. Contrary to the regular curriculum (students start with AutoCAD), they will learn Revit and ArchiCAD and apply this in the design studio. We will monitor their progress and aim to identify strengths and weaknesses of this approach.

DISCUSSION

In this paper we have identified hurdles that impede BIM adaptation in Czech Republic. These hurdles are not of a technological kind, but social, organizational, legislative, and organizational. As an educational institution we can make the biggest impact on improving BIM adaptation through all-BIM based education, and training a portion of our students to become BIM managers. We have experiences with a preliminary all-BIM design studio, and will initiate an all-BIM Bachelor program in the next study year.

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REFERENCES

- Achten, Henri and Matějovská, Dana 2011 'What is the goal in teaching basic CAD?', *Proceedings of eCAADe 2011*, Ljubljana, pp. 57-62
- Boeykens, Stefan, De Somer, Pauline, Klein, Ralf and Saey, Rik 2013 'Experiencing BIM Collaboration in Education', *Proceedings of eCAADe 2013*, Delft, pp. 505-513
- Kocaturk, Tuba and Kiviniemi, Arto 2013 'Challenges of Integrating BIM in Architectural Education', *Proceedings of eCAADe 2013*, Delft, pp. 465-473
- Russell, Peter and Elger, Dietrich 2008 'The Meaning of BIM', *Proceedings of eCAADe 2008*, Antwerpen, pp. 531-536