EDUCATIONAL INNOVATION IN ARCHITECTURE & ENGINEERING

Advances in final projects and thesis

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Mercedes Aldeanueva Fernández
Alberto García Marín
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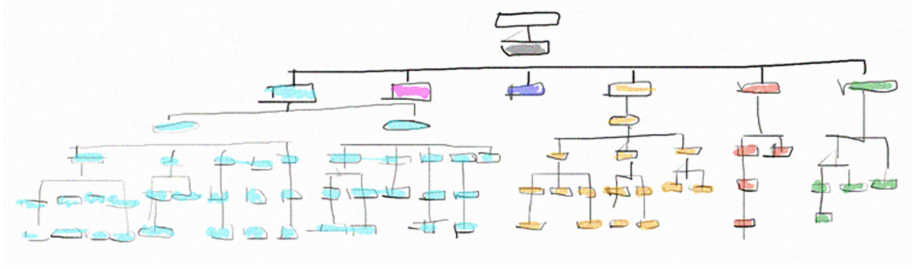

Figure 1. Organization chart based on hierarchies. Based on the version by Marco Vidali at the 1st BIMLATAM

Figure 2. Organization chart based on communication. Based on the version by Marco Vidali in the 1st BIMLATAM

1 CONTEXT

The obligatory use of the BIM method in Spain in 2018 involves all agents of the AEC sector, including Schools of Architecture to move away from their current teaching methods towards another which allows newly qualified architects to enter the work market. To do so, students must be trained not only in the use of new tools but also in the execution of their activity following a new work philosophy with a lot of potential in the communication and collaborative participation of all agents. In countries such as the United Kingdom or Denmark, job applicants are legally required to be proficient in BIM in order to be eligible for public contracts. Coventry University and VIA University College have incorporated BIM theoretical and practical training into their entire syllabus. In other cases, such as Penn State University, independent projects are carried out with undergraduate students from different years making up multidisciplinary work groups to develop a full project, while in British Columbia, in Canada, groups of research students are trained thanks to placements in companies which specifically produce BIM models.

In light of transformations of the sector in Spain, it is necessary to commit to effective teaching, with the understanding that the BIM methodology requires a more global approach within undergraduate and postgraduate education.The haste with which the labour market requires professionals is prompting the research and implementation of this new method, characterized by partial solutions which offer little coverage compared to the scale of the goal set. In spite of this, there have been visible improvements in the BIM training offered by some universities, which although far from ideal in terms of implementation, is successful in ensuring the training and specialization of recent graduates. In this way, universities such as Politécnica in Madrid, La Coruña, or Cataluña offer BIM Postgraduate training geared towards the tools and methods for project management and work. Others like Alicante and Cartagena offer complementary courses on BIM tools, or elective subjects to bring students closer to this new methodology. At the Escuela de Arquitectura de Málaga an Educational Innovation Project (PIE in its Spanish acronym) is currently in place to research and develop the guidelines and strategies needed for the correct implementation of this method.

2 FRAMEWORK FOR ACTION

One of the main pillars to be taken into consideration when tackling the shifting paradigm in working methodology is the transformation resulting from collaborative work, contrasting with the traditional patterns of companies and institutions. Workflow, responsibilities, transfer and accessibility to information lead to the obsolescence of rigid hierarchical structures which give way to more communication-based fluid and flexible organizations, facilitating work.

The complexity that these new diagrams/workflows are acquiring makes it necessary to use new procedures. BIM projects are regulated by BEPs, global documents essential to establishing the scope and coordination of collaborative

work by all participating agents in the different phases of a project. The BAP (BIM Academy Plan), a draft document designed as a guide to regulate the project for the implementation of the BIM Methodology in the academic sphere, was first mentioned at the EUBIM International Conference in Valencia (2017).

In the BAP the 'project phases' are understood as the different academic years, with teachers and students becoming more involved in BIM as academic years progress. The 'agents or disciplines' intervening in the project and regulating BEP are the different areas of knowledge taking part in the implementation of BIM in the Schools, with varying degrees of involvement depending on their nature.

BAPsare divided into two blocks:

- Training of all agents (students + teachers)
- Plan Coordination and management

2.1 Training of agents

Teachers and students in schools must be provided with training regarding tools and methods. In the case of the former, training will be geared towards the management and supervision of projects, where there is a need for visualization and verification tools for use in monitoring projects. As academic years (phases) progress teachers should learn more about the importance and management of the software used in their subject in order to help students, more for organizing and planning the Project under development, rather than the modelling itself.

In addition, students are expected to be responsible for their own learning, reinforcing this with elective subjects which make it easier to acquire the necessary knowledge to produce more complex models and planning. The last years must include subjects for teaching Work Dynamics, based on good practices in modelling or the culture of production and communication.

The main aim is to teach and instil the potential and complexity of managing and planning collaborative work, where tools for modelling, supervision, visualization, control, etc. must always be used taking into account the overall work of all participants in the projects. This training is divided into the following stages:

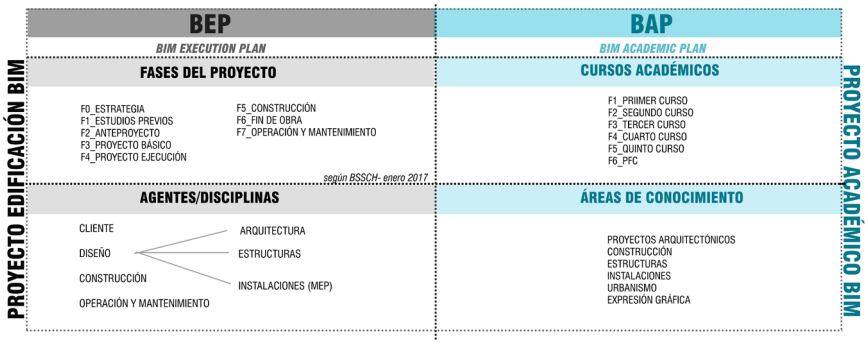

Figure 3. Relationship between the BIM Building Project and the Project for the Implementation of the BIM Method in Schools of Architecture. Authors' own. 2017

Early Stage:

1. Training teachers in tools for Revision + Coordination and Method
2. Training students in BIM tools

Advanced Stage:

1. Collaborative work between students of the same School – subprojects, templates, browser organization, etc.
2. Training students and teachers in project management, good modelling practices and collaborative work dynamics.

2.2 Coordination and management

The block on coordination and management is the most closely linked to BEP, as a written document is based on this to regulate the implementation process from the first year of studies until the completion of the Degree Projects by students.

Included below is a brief overview of the topics to be studied and presented in the document to ensure the correct implementation within the School:

1. Description, objectives and scope of BIM implementation in the School, as well as the presentation of all the members actively taking part in the process.
2. Analysis of the current situation, making use mostly ofinterdisciplinary subjects.
3. Definition of the stages and objectives of the process. Grouping by academic year. Definition of collaborative work based on the phase.
4. Drawing up collaboration protocols between the different areas of knowledge.
5. Presentation of action plan for the attainment of goals set for each stage, and coordination of the teachers involved in these actions.
6. Establishment of a system for supervision and assessment in order to control the implementation process.

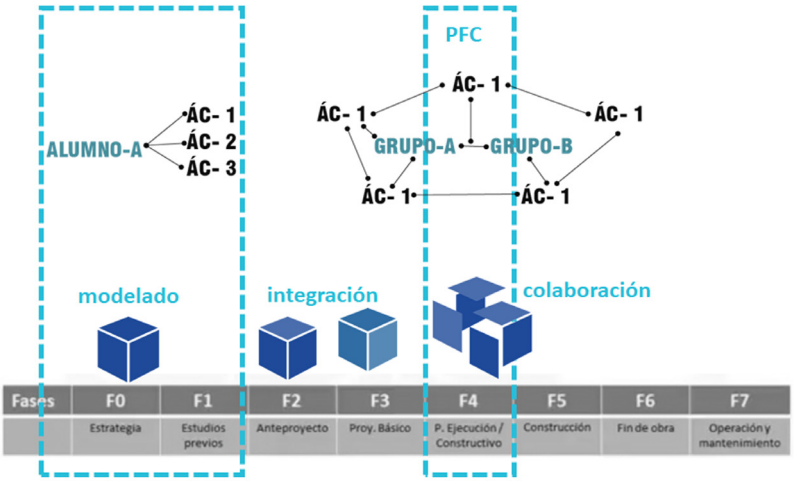

Figure 4. Relation of phases/academic years with collaborative work. 2017

3 COORDINATION AND MANAGEMENT _ FINAL DEGREE PROJECT

BIM achievements are usually showcased at the Degree Project stage. In the framework of BIM implementation this project is achieved thanks to a BEP of the design to be developed by the student.

Even though the designs carried out by students in previous academic years also had access to a similar BEP document for the purposes of guidance, it is with this degree project that students are able to work with agents external to their own School, and taking part in drawing up the BEP as part of their own project.

Some of the sections considered indispensable to a BEP-Degree Project document are:

1. Main Information of the Project – who, what, where, what for ...
2. Definition of project objectives in relation to the BIM model - what will the model be used for?
3. Format of the files used in the design - work format for collaborators, format for the submission of the revision by tutors, final submission formats, etc.
4. Client requirements - what does the tribunal want?
5. Planning of the work. Division of BIM and responsibilities. (Architecture + Structure + Installations).
6. Matrix of work method of the files (links/overlaps) in collaboration.
7. Information Exchange method (Autodesk 360, Dropbox, Google Drive, etc.) and information structure.
8. Protocols for collaboration and specific criteria for the model (templates, file size, synchronization, subprojects, levels, etc.)
9. A LOD matrix, determined by the requirements of the tribunal, taking into consideration the theoretical scope of the project, that is to say, there is no question of a LOD 400 or higher.
10. Nomenclature used to define the model files, subprojects, views, phases, parameters, elements, materials, delivery files, etc.

The teachers or tutors in charge of the different areas, in collaboration with their students, will draw up this document as intervening agents, and will have acquired the skills and competences needed to review and supervise the students' work, as well as to create a collaborative setting where students can take part in a completely interdisciplinary creation process through which they can gradually discover the importance of collaboration between all parties.

4 REFERENCES

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Education is at the center of humanity's fundamental rights, it transforms our lives and it is the culmination of one of the basic aspects of our full exercise as such, contributing to the consolidation of peace, the eradication of poverty and the encouragement of sustainable development. As a fundamental right accessible to all, education must go hand in hand with quality and innovation. The role educators play is crucial in the way they generate innovative experiences that turn learning into a creative, dynamic, enriching and motivating process, producing tools which make possible a responsible and mature education that is committed to society.

In the branch of Architecture and Engineering innovation in higher education acquires even more relevance, since it has a significant impact on the improvement of the autonomy and motivation of students in a collaborative and knowledge transferring working environment.

This publication gathers methodologies, projects and experiences carried out in Architecture and Engineering Schools, showing the optimum results of innovative practices in learning practices. This material aspires to contribute both to the training of students and docents, while it also aims to generate debate and reflection regarding academic and professional practice and therefore introduce the necessary changes to guarantee a comprehensive and innovative education in accordance to the needs of the individual and our advanced society.

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