Building design teamwork supported by a collaborative CAD modeling process analysis

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Keywords: CAD, collaborative teamwork, workflow

Collaborative tools are information systems which allow document sharing through local area networks, intranets and extranets. Collaborative design can be a solution to increase the productivity and the final quality of the product in a building design office. In this way it is possible to assure the information integration and also the data integrity during the design process based on computer network communication.

BIM (Building Information Modeling) is the process of generating and managing building information in an interoperable and reusable way. Thus, through a BIM model it is possible to integrate and reuse building information and domain knowledge through the building lifecycle (Lee et. al., 2006). BIM CAD use is emerging new working methods for design process which should be studied and demonstrated to its widely adoption.

Therefore, the goal of this article is to present an experience of architectural design development with virtual collaborative design using a BIM CAD system (ArchiCAD from Graphisoft/Nemetschek). This system has certain collaborative (teamwork) functionalities that can support a collaborative teamwork structured on an integrated model for different design views.

The research method used was exploratory case studies. The developed two case studies allowed rate the teamwork integration in the design development. For the method was established communication guidelines that helped the administrator and team leader in the early decision making before the beginning. These communication guidelines have been divided into three steps. The first was the communication requirements where the administrator defines the team that will design develop and all necessary requirements. The second step was the distribution of information, where the team leader distributes tasks to each involved in the design. As the design is being developed should be a continuous control which has been suggested as a third step.

For this research were conducted one pilot test and two case studies in a design office. The first case study was based on a non complex architectural design of low income residences with 33 m2 distributed in double and single rooms; living room; restroom and kitchen. The other one was based on a house design with total area of 350 m2 distributed in two floors. The first composed of garage, living room, kitchen, service, and home theater. The second floor consists of suites, bathrooms and living. In all studies, as well as test pilot, the working group was composed of three members.

ArchiCAD is one possible choice for this research because it offers tools to allow designers work simultaneously on the same design through the “Teamwork” functionality with a shared ArchiCAD project. A design team using the collaborative tools can be organized throughout different ways. Then, it is possible to use rigorous sets by defining strictly hierarchical access privileges in large offices or it is possible to leave more freedom setting in smaller practices, where the team working is in face-to-face contact. Updates to the design are done through “sending and receiving changes” function, but
the changes are only visible in other teammate’s copies if they choose the “Receive Changes” command. The revisions and the communications can be supported by the “Mark-up tool”. The management of the assigned tasks is done by the team leader and the status of each entry is controlled through the “Mark-up styles”, which determines the progress each entry. (ArchiCAD, 2007)

During the design development, the team leader noted conformities of the proposed design with what was being developed by teammates but also makes the compatibilization of the entire design. Like with any other technology the deployment of ArchiCAD as a tool in the design development at the design offices should occur gradually. In that way it is possible to take many benefits that this tool can bring to them. This tool helps in the whole process of design, forcing companies to be organized structurally in order to create hierarchies between the people who are participating in the design project collaboratively. But if the team is not well trained, and the collaborative principles are not passed, the tool can generate many conflicts of communication and information. In figure 1 follows advantages and drawbacks encountered in using the CAD system during the case studies.

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<th>Advantages</th>
<th>Drawbacks</th>
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<td>- Increased integration among all the team workers in the design development</td>
<td>- The messages that are sent through the tool mark up are not notified for whom receives them. The effective communication is not reached.</td>
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<td>- Monitoring of the whole design by the coordinator</td>
<td>- When there is lack of element in the mark up, such as the recipient, the tool does not notify this flaw which has just generated some message conflicts.</td>
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<td>- Easiness in finding non conformities in the design, since the tool allows continuous consistency checks.</td>
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<td>- Easiness to view and overlap automatically the drawings, with team leader coordination assistance.</td>
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Figure 1. Advantages and drawbacks

The used guideline communication was vital to the initial structure of the entire communication. It improved the clearness and allied to and completed the other collaborative ArchiCAD tools. But it is important to point that these guidelines should be changed with each new project, which needs upgrading as they arise in the design office. Finally, after the case studies evidences, it was found that the plan should contain frequency definitions for sending and receiving messages in the mark up phase, to make it possible to organize the communication.

The main impact brought by a BIM-CAD tool in the collaborative process design refers to the possibility of using a virtual model of construction in order to simulate the shape and behavior of constructive elements. Therefore, from the model database, the collaborative design process becomes more integrated and efficient, thus less prone to errors.

Acknowledgements

The authors would like to thank to CNPq and CAPES, Brazilian funding agencies.

References