Integration of daylighting simulation software in architectural education

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The education of future architects should equip them with the necessary tools for utilizing available natural energy resources. Utilization of natural light in internal spaces of buildings creates large energy savings and provides a productive atmosphere for users. The training of undergraduate architects on the utilization of daylighting in buildings in Egypt is almost totally dependent on abstract scientific lecture format that is difficult for students to perceive. Simulation software tools could help in this respect by assisting students in taking a grasp of such a visual science.

Previous research either reported on methodologies of teaching daylighting (Mansy, 2004; Dubois, 2006; Roberts and March; 2001) or investigated the integration of building performance simulation software into architecture education (Charles and Thomas, 2009). This paper reports on an experiment in which professional simulation software tools were successfully integrated in the teaching of a daylighting course to undergraduate architecture students at the American University in Cairo, Egypt. The course is part of a new program in architecture education (Sherif et al 2008).

Generally, the "lighting" part of the course had the clear objective of providing the tools necessary for an efficient integration of daylighting strategies in the building design process and incorporation of artificial lighting control systems. The software Radiance and Ecotect were used. Groups of students were requested to conduct a research project and presented it. The experiment was conducted in two phases, the first dealt with the evaluation of the daylighting performance of an existing space (Figure 1), and the second investigated possible enhancements using various daylighting systems (Figure 2).

The method of assessing the integration of the software was initiated with a survey conducted to the eighteen students attending the course in the Fall 2009 semester before introduction of simulation software. After software integration, an in-depth interview was conducted with a sample of students. The results of this interview gave insight into potential questions to be included in the post-survey.

Findings from pre / post surveys and interviews were grouped into three categories. Each category dealt with student's responses in terms of perceptions towards integration of the simulation software in their education, its affect on their understanding / application of daylighting and finally their attitude towards daylighting as a science that is sustainable in nature.

The majority of the students had a positive perception of the use of software. No student thought that the software was “not very helpful”, and the majority of students thought that the software was “very helpful” or “somewhat helpful” in the capabilities of visual rendering (77%) and numerical analysis (93%), as opposed to theoretical explanation (54%) and manual numerical analysis (62%).
In terms of using software in the design process as tools for getting an accurate understanding of daylighting analysis, 60% of students showed their intention to use simulation software more often and before manual calculations. The majority also showed their understanding of when to use the software rendering capabilities according to the required task, whether it was as a quick method of analyzing available natural light (45%), or when showing a client daylighting performance in their designs (84%). However, Student general attitude towards daylighting was not considerably changed due to the use of simulation software. They were quite positive about daylighting and its importance as a building science even before serious engagement with the software.

Output of this experiment showed that teaching daylighting science was significantly improved by the visual engagement that was offered by the computer simulation software. Integration of these tools in the education of architects could lead to building a new generation that could effectively utilize daylighting strategies into their architectural design projects.

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