The New Construction Classroom

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INTRODUCTION

Construction methods are rapidly changing with the desire to improve efficiency and lower costs. Construction education must also change to provide students the skill set required to be highly employable once they graduate. The Del E. Webb School of Construction (DEWSC) at Arizona State University has taken the initiative to not only transform the curriculum but also the methods used for teaching. This paper will discuss key changes in the methods used to instruct students to better prepare them to enter the workforce.

Courses taught in a traditional classroom setting, typically arranged as rows of tables/desks and chairs, with an instructor lecturing in the front of the classroom are useful, but do not always provide the best learning environment for students. DEWSC has evolved a method of instruction to include more collaborative hands-on teaching methods. Students are no longer passive recipients of information, but are required to proactively participate putting what they learn into practice. This collaborative method also encourages students to acquire teamwork skills as they mimic scenarios that are encountered on a typical construction job-site. Transitioning to a collaborative method of teaching has also transformed the look and physical requirements of the classroom; in place of the rows of desks and chairs a Virtual Construction and Collaboration Lab (VC^2L) was developed.

BACKGROUND

Collaborative Learning is a pedagogical concept in which students work in groups and benefit from peer learning while achieving a common academic goal. It fosters critical thinking and problem solving skills by promoting discussion, clarification and evaluation of ideas (Gokhale, 1995). Collaboration in all aspects of design, engineering, construction and management is critical for defining better delivery processes for constructing the built environment. “The current trends in alternative project delivery contractually require an increased level of collaboration throughout the life-cycle of a project (Bullain and Downey, 2011).”

VIRTUAL CONSTRUCTION AND COLLABORATION LAB

To facilitate effective collaboration, the space planning program for the VC^2L called for features that would stimulate group work and conversations while providing supporting tools and technology. The literature on behavioral patterns, knowledge sharing and practice methods are extensive, much of it prepared by space planners, furniture companies and computer scientists. One such report, sponsored by Herman Miller Furniture Company, concluded that co-location, proximity and visual access are the prime design considerations for making a room for collaboration (Miller, 2012).

Based on the review of literature the VC^2L classroom was developed by DEWSC as a pod-based collaborative learning environment, wherein interdisciplinary groups of students can investigate real-world projects from the viewpoint of industry representatives in their own particular field of study. The design and layout for VC^2L went through several iterations to recreate an atmosphere of collaboration, similar to the interior of a construction site office. The idea was to exploit the full potential of the experimental space by providing easy flexibility between group, lecture hall and conference room settings. The maximum capacity of the available space was set at 30 considering the intake of the course. Studies indicate that smaller group sizes (less than 4) lack the diversity and varied expertise for collective decision-making and larger groups (more than 6) do not ensure participation of all group members (Gokhale 1995). Considering this, it was decided to limit the number of members to 6 in each pod. The lab is equipped with sophisticated computing systems including well-configured computers to handle modeling and simulation exercises, LCD screens, and projection screens. The main room controls are consolidated at an instructor station which functions as the centralized server, creating a local

network for the lab. Sophisticated switching devices allow the function of replicating the screen content of any of the five pods onto the front projecting screen or to any of the individual pods, see figure 1.

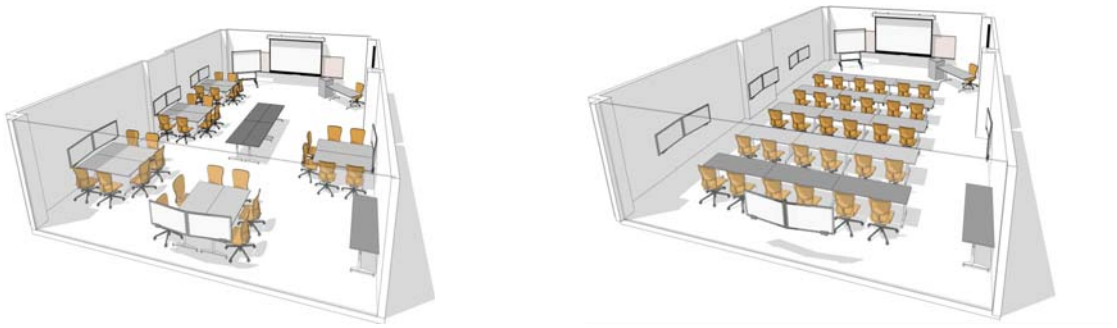

Figure 1: VC2L Arrangements

Once the layout of the VC^{2}L classroom was established the curriculum was revised along the same lines, namely, to make collaboration the key focus the classroom activities. In the VC^{2}L classroom, collaboration takes the form of team assignments centered on, modeling construction project life cycles, with special emphasis on the pre-construction phases as this is when major decisions regarding contract schedule and cost are confirmed. Utilizing Building Information Modeling (BIM, the current leading edge technique within the construction industry, a digital representation of a project is provided to the students that allows the input and extraction of project information by the project team to support the project delivery process. In the VC^{2}L, students are engaged in not just learning the tools that constitute BIM, but also in applying these tools understand how they improve the construction process.

BIM implementation at ASU focuses on a hands-on learning approach utilizing a combination lecture and lab. Lab time is preceded and supported by a project management lecture; theVC^{2}L provides the environment to test and execute BIM on real life projects. The practical realities of BIM are developed and reinforced during the weekly class supported by a variety of guest lecturers including architects, construction managers, subcontractors, engineers and suppliers. The lectures provide examples of how BIM has been put into practice across the project lifecycle, including topics in modeling, preconstruction, coordination, fabrication, and commissioning. During the lab period, students use structured tutorials, supplemented with videos, to implement BIM skills, often utilizing real building information models. The customized tutorials provide a step-by-step guide to the software, allowing for self-paced learning, as well as easy future reference. Industry BIM professionals assist with delivering the material, advising on best practices, challenges they face, and the importance of a skill within their day-to-day practice.

CONCLUSION

Industry involvement has continued to improve the course offering by including relevant areas of information and skills necessary to enter the workforce. However, it is critical to capitalize on both the intra and interdisciplinary collaborative aspect of BIM to set higher standards for research and development, education and practice. The long-term goal is to develop a curriculum progression involving the use of BIM tools at every relevant stage of a student's academic career, culminating in a capstone project.

The Virtual Construction and Collaboration Lab will become the environment where students apply their education and skills to solve real world problems. It also supports the development of critical thinking skills, which are not directly taught in any course, but are a vital quality to improve the industry. Moreover, the VC2L acts as a catalyst for research of methods and technologies of the future.

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