



Engineering: A project-based course that integrates design and construction

A course entitled "Integration of Design and Construction" by Dr. Albano and Dr. Salazar, Department of Civil and Environmental Engineering at Worcester Polytechnic Institute (1998)

Course Design:

The architecture, engineering, and construction (A/E/C) industry is rapidly changing in response to competition within the market, and firms are increasingly integrating the three functions in their project teams. In order for this approach to be successful, it is necessary for the teams to be able to effectively break down the traditional divisions between design and construction and take a cross-disciplinary yet specialized approach to cost-benefits analysis and decision making. In response to the compartmentalization of subject matter in the traditional curriculum, Worcester Polytechnic Institute has developed the Master Builder Program, which is a Master of Engineering degree program for professionals in the A/E/C industry. The curriculum highlights the interrelationships between designers, construction managers, owners, and developers. The program ends in a capstone course in which individual or small groups of students develop a systems-based approach to the planning, design, construction, and management of a facility. Students make detailed, written technical reports on their project which they then present orally.

"Integration of Design and Construction" is one course within the Master Builder Program. The course comprises four principle activities: laboratory, class discussion, faculty lectures, and a term project with industry. Students were organized into project teams with members specialized in each of the three principle disciplines. Laboratory exercises required project teams to develop solutions to the questions posed from three different perspectives: the structural engineer, the contractor, and the owner. Class discussions were based on project group presentations on the laboratory exercises, questions from the assigned readings in professional journals, and term project status reports. The class as a whole reviewed conclusions, processes, and terminology use; this allowed for clarification of new material as well as feedback on the quality of

student work. Brief faculty lectures addressed topics not covered in the readings or laboratory exercises.

The second half of the semester was dedicated to simulating involvement in an ongoing, real project. In many instances, the project manager for the owner or the structural engineer or the contractor are available to present to the class. On the basis of the case study, project teams made a series of presentations on the preliminary design of the site and the detailed design for the structural framing. At the end of the semester, each team submitted its proposal in both a written report and an oral presentation. In response to the oral presentations, a member of the A/E/C team for the actual project would play the role of the client as well as provide insight into the progress of the real project.

Higher Level Learning:

The principal goal of the course is to overcome knowledge compartmentalization and give students insight into the vital connection between the architects, engineers, and contractors in an effective design team (**Connecting**). Students reevaluate their approach to projects and learn how to develop an integrated approach to design and construction planning (**Acting**). The course emphasizes the changes taking place in the A/E/C industry and provides students with insight into what they will need to know and be able to do in order to be qualified members of such professional teams (**Learning**).

Active Learning:

With each aspect of the team projects, students were able to experience the dynamics of project teams composed of professionals from the different backgrounds within A/E/C (**Doing**). The cohesive effort required of them compelled students to rely on strong inter-group cooperation (**Dialogue with Others**); it also prompted students to learn about the skills and perspectives of each field in the industry (**Observing**).

Albano, L. D. and Salazar, G. F. (1998). Project-Based Course for Integration of Design and Construction at WPI. *Journal of Professional Issues in Engineering Education and Practice*, 24, #4, pp. 97-104.