The Interdisciplinary Design Studio: Understanding Collaboration

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ABSTRACT: Intuitively designers know that teamwork is necessary to produce a cohesive project. Collaborative team work, or team work across disciplines, is a fundamental basis for firms such as Arups and Buro Happold among others and these firms are known for producing innovative work as a result of their collaborative efforts. Studies have shown that collaborative efforts can produce new and original ideas not possible in a uni-disciplinary setting[1]. The potential to develop intriguing design solutions while requiring students to work in multi-disciplinary teams is one of the primary goals for a new studio course at Cal Poly San Luis Obispo.

1 INTRODUCTION

Two years ago instructors from architecture and architectural engineering developed a collaborative design studio that used a steel design competition, sponsored by the American Institute of Steel Construction, as the vehicle to implement an integrated studio. The steel competition was selected because it presented a building with a modest but well defined program, an opportunity for creative architectural and structural design, and presented a building type that all the students could relate to[2]. The design process was complicated by the fact that the design teams consisted of architecture and engineering students, groups which solve problems in distinctly different ways, but enhanced by providing moments for the student groups to collaborate and learn the nuances of communication. Also working in the student's favor was the fact that the course was offered over a six month period and the project schedule was developed using the instructors' years of experience in practice.

The design studio was committed to working in integrative and interdisciplinary teams to develop the competition project. Each discipline contributed their expertise to the project from the first day of the quarter. This allowed for a deep exploration into program, performance, and constructability. It also forced each team to develop a strategy that was compatible with the challenges of collaborating across disciplines, while at the same time developing team strategies that accomplished project milestones in an integrative work environment. These interactions were arrived at by trial and error. Negotiation and eventually a mutual understanding of the positions that each profession brought to the table were understood by all. It was a goal to support the integrated team as a unified group and reduce the separation of the disciplines. Two additional faculty were brought onto the team as the studio was developed, making the faculty team function as an integrated team and reinforcing the concept of collaboration and team work, in essence leading by example.

In addition to the goals stated previously, our goals for this studio were:

- Teaching critical thinking skills to develop problem solvers for the future
- Creating speaking and writing opportunities to enhance communication skills
- Developing group projects so individuals learn about group dynamics and the nuances of negotiation
- Exposing students to problems that reflect real life situations so students can learn from past mistakes and become confident to tackle future problems

The student projects were developed based on information received or gleaned through site visits, design meetings, design team correspondence, project calculations and detailing, and project reviews by practicing engineers and architects. Projects concluded with an oral presentation to faculty and visiting practitioners and submission of a project binder. One of the submissions last year won an honorable mention out of 400 plus submissions.

2 THE KICK-OFF

As noted previously, the studio is offered over a six month period or two ten week terms. To introduce the students to one another an icebreaker activity is assigned. The activity is typically a short exercise that requires collaborative teamwork since the studio is highly dependent on interaction across disciplines. This initial exercise is very important. It allows the students to not only meet each other, but highlights the differences in the way each thinks, approaches and solves problems, and describes various attributes of a structure. The students work in teams of four to six and are judged for structural efficiency and architectural expression. The kick-off activity is an inexpensive model building exercise such as a bridge that must support an instructor and allow a ball to roll beneath it or a high rise structure that must withstand a simulated earthquake. Examples of these activities are shown in Figure 1 below.

Figure 1: Icebreaker Activity

3 CREATING TEAMS

The student teams were based on short presentations, two to three minutes, by each student. This allowed the instructors to identify which students had similar goals and reasons for enrolling in the studio and more importantly develop teams where the students had similar aspirations. Teams of five students were formed – typically two architectural engineering students and three architecture students.

The teams were formed by the end of the second week of instruction and from this point on all exercises and activities were conducted in the newly formed design teams. And to help foster the formation of team relations, the studio was arranged with desks in clusters rather than individual work stations.

4 BUILDING A VOCABULARY

The next exercise was a precedent study. The precedent buildings were selected by the faculty and demonstrated a unique way of solving a problem similar to the project program for the design competition. As an example, in the first year the design competition included public housing in an urban area as part of the program. To better prepare the students for the competition, successful and innovative housing projects were selected for research. Example projects included high density solutions as well as low rise urban renewal examples. The student teams were required to analyze the site context, the space organization and program, and the structural system. The projects concluded with a presentation.

This exercise is not new to architecture students, but for the engineering students this was their first exposure to researching a building as a means to expand their horizons. Typical engineering curriculum focuses on engineering principles and the design of basic structural systems, so exploring architecturally expressive structures that utilize structure as part of the design and that push the structural envelope were invaluable. It allowed the students to see what can be achieved structurally and how to push the envelope of structural design.

More importantly, it exposed the students to the nuances and subtle differences in "building" vocabulary. When one speaks of materials or materiality it means one thing to an engineer and another to an architectural designer. When one expresses the need for bracing or support, it relates to the load path and stability to the engineer, but planning and circulation to the architect. This was the starting point for the engineers and architects to understand each other.

5 DESIGN CHARETTES

Design charettes were used to kick start the design and collaboration process. One of the keys to success in practice is the formation of partnerships.[2] Most successful partnerships involve communication and familiarity amongst the players. It was the instructor's notion that working together early in the design process for an extended period of time would help develop partnerships amongst the team members and began to instill ownership in the projects.

The design charettes were scheduled over two days and ended with an informal critique. In the schematic development charettes students were required to address site analysis issues such as orientation, access, adjacency, and develop a multiple massing solutions to address the program. Basic structural systems were discussed but not developed at this time. The idea was to begin the design process and initiate the students to designing in a collaborative manner.

During the critiques students identified which solutions had a stronger basis of design and which aspects of each solution had the potential to be developed further; thus allowing for further iteration. The concept of design iteration is another key component to the collaborative design process. By synthesizing the good ideas from multiple projects into a single project will result in a better design. And during the critiques it was stressed to each team what worked architecturally and what worked structurally so the teams could begin to exchange and suggest ideas that solved both aspects of design.

Figure 2: Design Charettes

6 A FIELD TRIP: THE SITE VISIT

A key aspect to the class and a big enticement for the students is the site visit. Each year the faculty team selects a city to match the program. One year it was Seattle, Washington and the

next Phoenix, Arizona. The idea is to expose students to environments and cultures different than those they are familiar with. After the design charette, the students and faculty traveled to the site for four to five days to explore the city, visit the site and conduct an analysis, and visit architecture and engineering firms.

The students worked in their design teams and conducted a site analysis and documentation exercise. (See Figure 3 below) Students were assigned the same tasks as during the charettes; access, adjacency, day lighting, etc., but now formal relationships could be established based on the actual site. Additionally, the students concluded their analysis with a short design charette and review. The intent was to have the teams critically develop building orientation and siting schemes based on the studies.

Office visits excited the students as well. Visits to offices that exhibited collaborative solutions were paramount. The exposure to real world solutions and having the engineer of record or the architectural designer tell the story about how the building was conceived was invaluable. Students learn how architects and engineers can work together, the give and take of design, and the value in working in an integrated fashion.

These are all valuable experiences, but one of the other valuable aspects of the field trip is the opportunity for the students to bond in a non academic setting. Students can spend the evening to together

Figure 3: Site Visit activities

7 MILESTONES: THE DESIGN REVIEWS

Like all studio courses, design reviews in front of a jury are the norm. The twist given to the Collaborative Design studio was that the teams presented together and presented architectural design, as well as, structural design solutions to a jury consisting of faculty and friends from industry. The opportunity to receive input and thoughtful criticism from someone currently practicing their trade is very useful to the students. Students tend to value comments from industry friends and feel their comments are valid since the individuals from practice are immersed in the profession on a daily basis, in short, many students view reviews by practitioners as an interview for a job. This also works in the faculties favor since the students take these types of reviews very seriously; the quality of work presented is typically of higher quality.

Also, depending on the design phase, the emphasis of the review was tailored to match the design stage. Early reviews were primarily architectural with structural support, intermediate reviews were balanced and the latter reviews focused on structures with architectural support. This allowed each team member to speak about their work, but more importantly, observe how their role evolved over the life of the project.

Figure 4: Design Reviews

8 FRIENDS FROM INDUSTRY: THE GUEST LECTURER

The studio has also been very fortunate by having friends from industry visit classes not only as jurors, but also as guest lecturers. During the past year industry professionals specializing in sustainability, environmental engineering, and digital technology have provided guest lectures to supplement and reinforce the lessons delivered in class. This helps the students better understand the roles allied disciplines play in the design process. As an example, Autodesk training and education specialists have conducted workshops for students to learn how 3D platforms such as Revit can be leveraged to help coordinate work across disciplines, develop massing models, and seamlessly create structural models. The goal is for students to learn workflow options as well as understand current trends in industry. With the help of industry partners such as this, the students created digital models for architecture, structure, and environmental analysis as shown in the figure below.

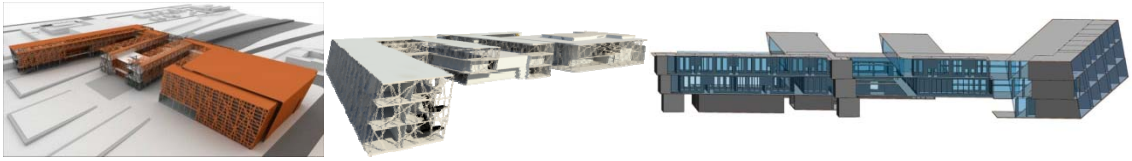

Figure 5: Digital Models

9 LESSSONS LEARNED

Like all new courses, lessons are learned as to what works and what doesn't work. One of the authors has been teaching an interdisciplinary studio for the past five years and many of the lessons learned from that studio experience are implemented into this studio. Unfortunately, everything learned in one setting cannot be transferred to another. Over the past two years the faculty team has learned that students at Cal Poly need assistance in;

- establishing working relationships that resemble the working world
- working through the initial phases of design – scheming a building as a multi-disciplinary team
- developing roles within the team – project management
- identifying changes that effect their work and others

Also, the students submit a written final as part of the process and one of the questions asks what works and what doesn't. All the students enjoy the experience of working as a team, but they have commented on team work issues within their discipline, team work issues across disciplines, and work flow issues. It was interesting to note that the issues identified by the students reflected the concerns of the instructors.

10 PLANS FOR THE FUTURE

Students who complete this studio work in multi-disciplinary teams, which is an important learning experience. When working in multi-disciplinary teams, students learn:

- how to communicate effectively across disciplinary divides
- how their disciplines is incorporated by and impacts other disciplines
- how other disciplines impact and influence their work
- how to create integrated systems that meet the goals of each stakeholder

This year the studio is being expanded to include the following:

- Enrollment of construction management majors (CM)
- Sustainability / green building design
- Building information modeling (BIM)

Our department is implementing mandatory interdisciplinary studios and it is the instructors' goal to offer this course annually to fill that requirement. The purpose of the paper is to share our lessons learned from offering a collaborative approach to a steel design competition and to share our plans for the future, which includes the inclusion of construction management students and the use of Building Information Modeling. The design profession in the United States is finally moving to a more progressive collaborative model and the instructors goal is to produce students who think collaboratively because the results can be superior to those when working in a uni-disciplinary environment. The Collaborative studio has been a success over the past two years and with a little luck will continue to evolve into a campus model worthy of emulating.

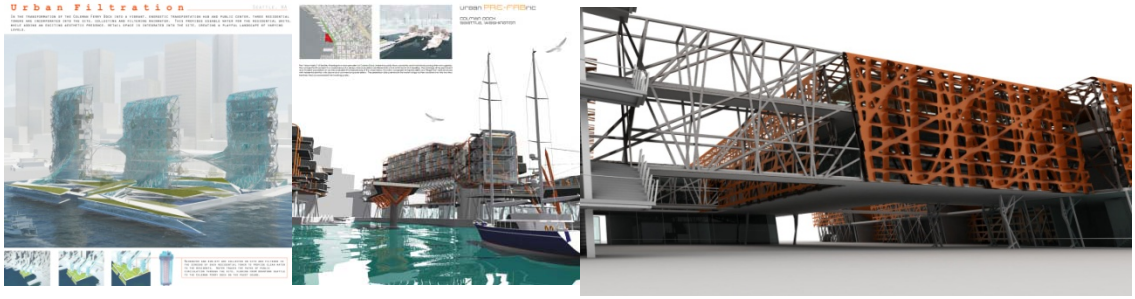

Figure 6: Sample Project Boards

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