A Real-World Process for Transportation Senior Design

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Abstract

The senior design or capstone course in transportation is the culmination of four years of intense engineering education at most accredited Civil Engineering programs. Senior design often includes a single team-based real-world project which incorporates various analytical skills developed over the course of the student’s education. By its nature as a project-based course, it frequently includes report-writing, presentation skills and solving problems as a team - critical skills for entering the workplace upon graduation.

In our transportation capstone course, we not only focused on a real-world problem for their project, we focused on a real-world process. The quarter consisted of the shortest version of the consulting process of proposing on a project, executing the project on time and on budget and presenting final solutions in a public meeting. The course began with students applying for a job in transportation / construction consulting and being assigned to a work team (company). Each company then proposed on a work contract and attended an interview presentation. Upon “winning the work”, each team completed their work to produce a status report and presentation to their clients and a final report and presentation at a “public hearing”. The primary goal of the course was to present students not only with an opportunity to work on a real-world transportation project, but to do so in an environment similar to that you would find at a consulting firm.

Skills Emphasis

- Project Management
- Time Management
- Technical Research
- Field Research
- Alternatives Analysis
- Giving Presentations
- Writing Technical Reports
- Teamwork

Teaching Components

Teamwork - Although all of the students had previously worked in groups on projects, they had not interacted with their peers at this level. In this course, their group was responsible for completing all assignments as a team. For this reason, we began the quarter with team exercises to help them get to know each other’s strengths and weaknesses as well as set up the structure of how they would like to operate. We also shared handouts with tips for successful teamwork, including roles team members should be taking on (chairperson, note-taker, editor) and those they should not be taking on (coach potato, hitchhiker).

Presentation Skills - Similarly, although the students had previously given presentations in many courses, their training in giving technical presentations was limited. Therefore, we had an interactive lecture emphasizing best practices for delivery, visual aids, organization, and content in giving technical presentations.

Project Management - The entire process of the course focused on providing a real-world experience related to the management of a project. The students were issued a Request for Qualifications to which they responded in the form of their proposals to win the work. They were then given a Contract and Scope of Work to guide them through later components. Their management of the project included keeping the team organized and on task, preparing minutes for all team meetings, preparing invoices for the client and formatting their report in a professional manner. Handouts and lectures were designed to enhance these skills.

Schedule

| Week 1 | Introductions Building Teams |
| Week 2 to 4 | Guest Speakers |
| Week 3 | Interview Presentations |
| Week 5 | Project Management |
| Week 6 | Presentation Skills |
| Week 7 | Status Presentations |
| Week 8 to 9 | Time for work - |
| Week 10 | Final Presentations |

Research Guidance - The student’s work for the particular problem they were assigned was guided through presentations by guest speakers, a course website with links to resources and individual interaction with the instructors.

Deliverables

Proposal
- Company description
- Design personnel, experience
- Project objectives, methodology
- Budget of hours to complete the work

Interview
- Oral presentation to client
- Written presentation to client
- Analysis of approach

Status Report
- Existing Conditions
- Preliminary Analysis
- Proposal Options
- Status of Budget and Timeline

Client Status Meeting
- Written report to client
- Oral report to client
- Analysis of approach

Public Meeting
- Status Report Presentation
- Alternatives Analysis
- Final Design
- Written report to public
- Coach among different stakeholders
- Detailed client input:
  - Elevate presentation and Q&A

The primary deliverables students prepared are shown in the chart above. Five additional deliverables related to the structuring and operating of their team (company) were a critical component of the course. On the first day of class, the students filled out job application which enabled us to place them into teams based on their differing skills. During the first week, each group completed a team contract to set up the ground rules for their collaboration and meetings. Throughout the quarter, each team had to turn in weekly meeting minutes with an agenda, notes from the meeting, work tasks assigned and the next meeting times. With each report, the teams turned in an invoice showing their hours worked to date multiplied by hourly rates with direct expenses, overhead and profit added in. Finally, the individual grades were assigned at the end of the quarter based on a team evaluation that each team member completed.

Conclusions

The class was a successful introduction to aspects of their future careers that students are traditionally not trained in during the course of their undergraduate education.

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