Aligning Lecture and Lab Course Components for Improved Student Learning Outcomes in CE 562

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Civil, Environmental, and Architectural Engineering

The Course - CE 562

In Civil Engineering 562, students are expected to demonstrate proficiency in analysis and design of structural steel members and building systems by completing a semester-long steel building design project. CE 562 is a three-hour, senior level course taught in the fall and spring semesters. Prior to this academic year, the fall semester was taught in a traditional lecture format. In Fall 2016, the course was transformed with the collaboration of Caroline Bennett. Effort was conducted to ensure consistency in learning outcomes and student preparation upon course completion by aligning lecture, lab, and design project materials for both the fall and spring course sections.

The Redesign

A comprehensive redesign of the course was completed to align the lecture, lab components, and course goals, and to integrate the course activities. This included:

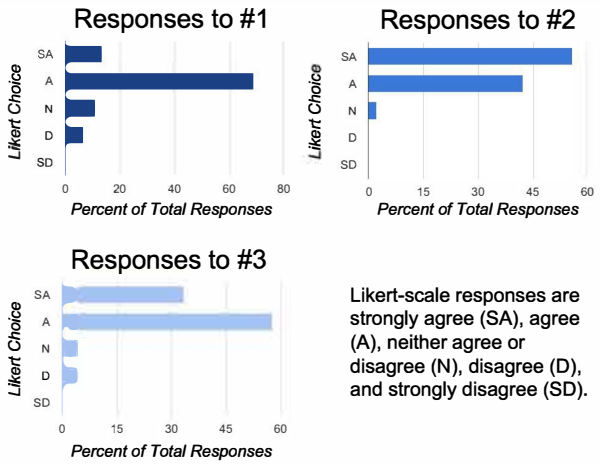
- Learning goals that were previously not well duplicated between the course components;
- The timeline of the course was restructured to appropriately sync topics between lecture and lab;
- An additional professional review of student projects, occurring mid-semester, was incorporated;
- Tiered peer mentoring was implemented into the course. Graduate students enrolled in course CE 765 served as external review checkpoints, providing graded feedback to undergraduate design teams.

Mid-Semester Project Review

Student projects and presentations were previously reviewed by professional engineers at the end of the semester; the redesign included an additional mid-semester professional review in which students presented their projects to the class and the panel of professionals. Students of the Fall 2016 semester provided feedback following the review and responded via a likert-like scale:

1. The feedback my group received during the mid-semester project review was helpful
2. Having to prepare for the mid-semester project review forced my group to be organized and develop a plan for the rest of the project
3. Hearing other group's presentations and the professional feedback helped my group find errors that we would not otherwise have found

Student Responses to Post-Mid-Semester Project Review Survey



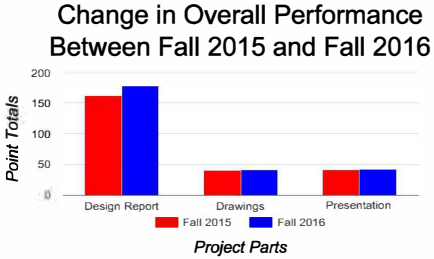
Likert-scale responses are strongly agree (SA), agree (A), neither agree or disagree (N), disagree (D), and strongly disagree (SD).

Student responses are generally positive overall regarding the mid-semester project review. Students were also asked their thoughts and opinions, which were generally positive:

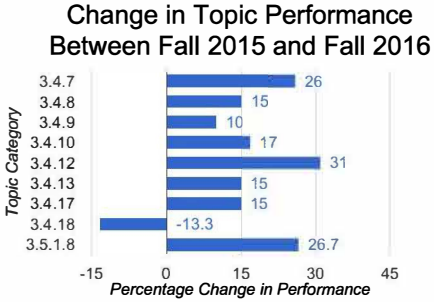
- *I found the panel review to be incredibly helpful and informative.*
- *It really gave us an opportunity to see where we were on the project in terms of completion, and as to where other groups are in their projects.*
- *I thought the mid project panel was a good idea because it made our group not slack off and have a good chunk of our project done midway through the semester instead of procrastinating until the very end of the semester.*
- *The most significant effect this presentation had was to get fully caught up in all areas of our design (especially CAD).*
- *Having a due date for certain criteria definitely helped our group focus and come together.*

Criticism of the mid-semester review generally consisted of students not yet prepared to cover all expected topics; repetition of presentations and advice; lack of specific feedback from the professional panel; and preferring to meet with only the panel and not as a class presentation to the panel.

Findings and Improvement



Final project rubrics between 2015 and 2016 were the same. Average project score improved 5.4%, showing a slight overall improvement.



Category	Topic
3.4.7	Brace Loading and Distribution
3.4.8	Lateral Deflection
3.4.9	Floor and Deck Selection/Design
3.4.10	Joist Selection/Design
3.4.12	Fill Beam Design
3.4.13	Girder Design
3.4.17	Beam/Girderto Column Web Shear Connections
3.4.18	Column Base Plates
3.5.1.8	Discussionof Connection Design and Economy

The above components of the semester-long undergraduate project showed a marked improvement from 2015 to 2016. Each improved topic correlated directly with student feedback of topics covered during peer mentoring meetings. The only topic to see a negative change was not mentioned in any peer mentoring meeting reports.

Conclusions and Looking Forward

The course redesign and alignment of materials between lecture, lab, and project likely played a role in observed student gains; however, the most improvement was seen in conjunction with the mid-semester project review and topics mentioned in peer mentoring sessions. In future iterations, a more quantitative evaluation of mentor outcomes and evaluation of graduate student gains will be implemented.