IPD/BIM Multidisciplinary AE Capstone Course Development

Duration: 8/1/2009-5/15/2013 (Completed)
Funder: The Leonhard Center (Penn State) and Thornton Tomasetti Foundation
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Outcomes: 3 journal papers, 5 conference papers

Background

Department of Architectural Engineering (AE) at Penn State University launched a three-year IPD / BIM Capstone Project Program under industry and institutional sponsorship. The project was co-funded by the Thornton Tomasetti Foundation and The Leonhard Center for Advancement of Engineering Education of Penn State. Consisting of a year-long two course sequence pilot program, this capstone initiative is organized and managed around IPD/BIM concepts involving multidisciplinary teams of architectural engineering students. Three teams were formed consisting of one student from each of the four Penn State AE engineering disciplines: Construction, Lighting/Electrical, Mechanical, and Structural. The basis of the entire 5th year of the program functions around the capstone course and how it represents the professional application of engineering knowledge.

Pilot Formulation

In order to understand how to develop such a course with forward things mentalities on relatively new topics, a comprehensive literature review was conducted. This work provided guidance into setting the foundation of the pilot. Areas of literature considered included but not limited to:

- BIM and IPD topics to incorporate
- Practice/problem based learning
- Learning objective via ABET
- Implementation strategies
- Evaluation methods

The focus of this project is extensive in the results determined through the three year offering. The outcomes from the pilot included:

- The formulation a curriculum outline and required deliverables
- Developing best practices for implementing IPD philosophy and BIM technology
- Determining the effectiveness of:
  - The course objectives
  - Student interaction
  - Industry integration
  - Teaching methods
Student Trends from Developed Objectives and Guidance

Within the student results collected over 4 years, there were several noticeable trends. Systems integration across disciplines is the most collaborative among the trends. Student generated designs require the input of at least two team members but can have as many as four providing input and suggesting design considerations. Topical studies included:

- Architectural concept and enclosure
- Day lighting and electrical system control
- Mechanical system integration
- Constructability of building systems
- Sustainability studies
- High performance structures

Advanced computer modeling technology was another prevalent trend. The generated outputs organized into this area rely on computer modeling through analysis, design, and simulations of the project for different purposes. The models can be used collectively for the group decision making or customized for more discipline specific studies. Model uses have been common to date in this trend match the systems integration topics.