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Teaching Collaborative Skills Through an Interdisciplinary Design Competition

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Teaching Collaborative Skills Through an Interdisciplinary Design Competition

Abstract

As educators we recognize the importance of preparing students for the interdisciplinary collaboration they will face in their professional careers. Integrated Project Delivery (IPD) is the emerging project delivery method of the time and is often accompanied by the use of Building Information Modeling (BIM). Construction management programs across the nation have adapted to the changing industry needs and trends by incorporating IPD and BIM into existing courses or creating new courses. Although educating students about the differences between IPD and other more traditional project delivery methods is seemingly straightforward, teaching the collaborative skills needed for IPD is difficult, especially when students lack the discipline-specific expertise upon which IPD relies. These educational challenges make the relationship between industry and academia of utmost importance.

This paper will explain the process and outcome of the fourth year of an annual, industry-sponsored design competition. The competition is intended to foster interdisciplinary collaboration among students in their fourth year of study, students who will soon be entering the job market. During the two-week competition, students from architecture, construction, graphic design and interior design work in groups to prepare a proposal addressing the needs of a client. The competition concludes with student presentations and the selection and ranking of the top three teams by the industry sponsor.

Qualitative and quantitative data was collected from the students in the form of an online survey completed at the outset and conclusion of the competition. The surveys are used to measure the students' knowledge and perception of IPD, and how that knowledge and perception changed as a result of the collaborative competition. The paper will also include an overview of the three prior years of the competition as a reflection of lessons learned and improvements made to the competition format to improve student outcomes.

Introduction

Construction productivity has declined at a rate of -0.32% per year for the 48 year period from 1964-2012.[1] Inefficiency in the delivery of construction projects is one of the driving forces behind the shift toward integrated project delivery (IPD).[2] IPD seeks to foster collaboration among the project participants throughout all phases of a project, from the early design phase to occupancy. It is defined by the American Institute of Architects California Council (AIACC) as "a project delivery approach that integrates people, systems, business structures, and practices into a process that collaboratively harnesses the talents and insights of all project particpants to optimize project results, increase value to the owner, reduce waste, and maximize efficiency through all phases of design, fabrication and construction."[3] Because each discipline has early representation in the project outcome, the project evolves in a way that meets the needs of all project participants.[4] By aligning the team goals and collaborating throughout the course of the project, efficiency is improved, errors are reduced, and adversarial relationships are reduced and/or eliminated.[2]

In a 2010 survey of 415 owners, architects, engineers, general contractors, and construction managers, 24.7% of survey respondents reported being both inexperienced and uninformed about IPD, yet approximately two-thirds of all respondents believe IPD will become the project delivery system of choice in the United States.[2] The challenge for educators is to prepare students for a project delivery method that is relatively new, constantly being redefined, and varies greatly based on the project and parties involved.

While it is widely recognized that IPD and Building Information Modeling (BIM) typically go hand-in-hand,[2] a separate study of 45 colleges and universities which are members of the Associated Schools of Construction (ASC) shows that 62% of survey participants found that BIM education was inadequate at the undergraduate level and is only being addressed in approximately 10% of undergraduate programs.[5] In his article, "Notes on the Synthesis of BIM," Randy Deutsch takes the position that Integrated Design, also known as IPD, is more than a delivery method. Deutsch quotes the GSA's Charles Hardy, who is famous for saying "BIM is about 10% technology and 90% sociology," when he states that we should focus our attention on the sociology of IPD while the 10% technology works itself out. Deutsch describes the "ideal synthesis" - the synthesis of "design and construction, BIM and IPD" - as allowing for: "BIM's inherent complexity, the complexity of the construction process, the design profession's discomfort with addressing means and methods, the constructor's discomfort with addressing [design] intent, and technology to work hand-in-hand with sociology."[6] Solutions to overcoming the sociological/cultural barriers include collaboration, communication, and confidence in the capabilities of the parties involved.[4]

In an effort to facilitate the ideal synthesis Deutsch describes, and so students will be better prepared to enter the job market with interdisciplinary experience, faculty members in architecture, construction, graphic design, and interior design from the College of Architecture, Art + Design at Mississippi State University, with the support of Brasfield & Gorrie General Contractors, conducted the fourth annual student design competition at the beginning of the Fall 2014 semester. Interdisciplinary groups of students teamed up to develop proposals for a retail incubator space in downtown Starkville, Mississippi. Anonymous student surveys were conducted at the beginning and conclusion of the competition to determine the students' initial understanding of IPD and any preconceived beliefs they had about the roles, strengths and weaknesses of the other disciplines, as well as how that understanding changed as a result of the competition.

The Competition

Educators and industry professionals recognize the need to prepare students for the interdisciplinary collaboration they will face in their careers. While not all aspects of collaborative project delivery models such as IPD can be replicated in an educational setting, beginning to overcome the sociological/cultural barriers Deutsch mentions, is possible by teaching students how to collaborate, communicate, and have confidence in the parties they work with. With this in mind, Brasfield & Gorrie General Contractors partnered with the College of Architecture, Art + Design at Mississippi State University to sponsor an annual design competition that pairs architecture, construction and interior design students together for a two-week competition at the beginning of the fall semester. In 2014, graphic design students were added to the collaborative competition for the first time.

The competition begins on the first day of class for the fall semester. In 2014, 78 students participated and were divided into ten groups consisting of students from all four disciplines in as equal distribution as possible. The classes met on Monday, Wednesday and Friday for four hours per day for the duration of the project. Several key pedagogical components allow this type of collaboration to occur. First, within the College, both architecture and construction students normally meet on the same schedule and both follow a studio-based format. Although graphic and interior design students do not typically have the same class meeting schedule, adjustments are made for the two-week duration of the project and both have an underlying studio-based curriculum. Another factor that facilitates this competition is that the architecture, construction and interior design programs all incorporate aspects of building information modeling (BIM) into their respective curricula. An additional contributing factor is that both architecture and construction students take six core curriculum classes together, such as structures and two innovative studios where architecture and construction students collaborate for an entire semester in the fall of their second year and spring of their third year of study. Also, construction and interior design students take a 3-D modeling class together.

On the first day of class the students were placed into groups based on the results of a questionnaire they completed about their personality type and study habits. The project was then introduced, a site visit was conducted, and each group was assigned a research area to gather and share background information about the site, zoning, Americans with Disabilities Act (ADA) requirements, traffic patterns, demographics of the city where the project is located, etc. The remaining class days were devoted to each group working together on its proposal with intermediate critiques with faculty. During these intermediate critiques with faculty, the students shared their preliminary work and were able to ask questions of faculty members, with many of the questions involving how to make decisions within an interdisciplinary group when individuals may have different decision-making criteria based on their discipline.

At the conclusion of the competition, all ten groups had the opportunity to present their work in a science fair-style review where guests are free to mingle throughout the space and ask questions in a more informal setting. Following that, the top three teams, selected by the faculty earlier in the day, had the opportunity to present their proposals to the client and representatives from the sponsor, who then ranked the top three groups. Each of the top three teams was awarded a monetary prize.

The 2014 project was to develop a proposal for an incubator retail space in downtown Starkville, Mississippi. The client had recently purchased the property and students were asked to develop plans for creating a space where up and coming entrepreneurs could display and sell their products before they were able to afford their own storefront. The project deliverables included the following items: constructability review, construction estimate and schedule, floor plans, sections, elevations, materials palate, and branding and signage for the incubator space.

Surveys

At the outset and conclusion of the project, students received an e-mail with a hyperlink, inviting them to anonymously complete an online survey via Survey Monkey. The purpose of the surveys was to assess how their understanding of IPD, collaboration, and the other disciplines changed

because of the competition. Seventy-eight fourth-year students took part in the competition: 26 architecture students, 19 construction students, 14 graphic design students, and 19 interior design students. Seventy students completed the initial survey, for a response rate of 95%, and 63 students completed the final survey, for a response rate of 81%. The discipline-specific gender distribution for the 34 males and 44 females taking part in the competition is shown in Figure 1, below.

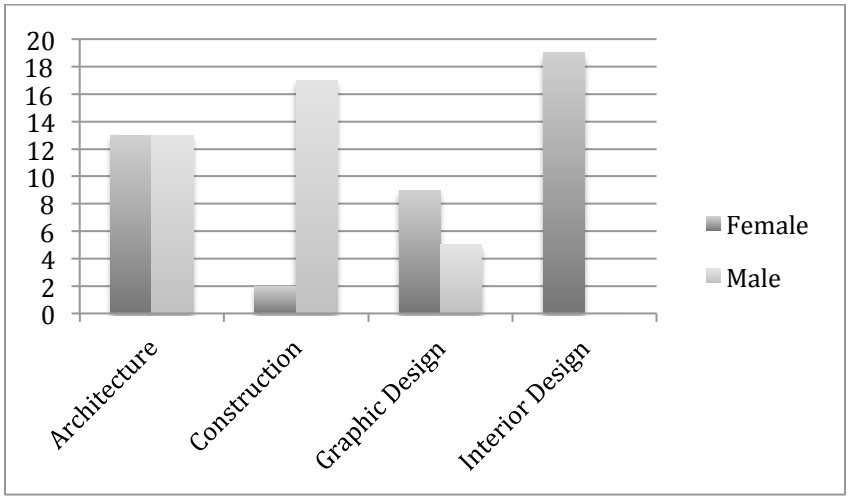

Figure 1: Participant gender by discipline.

Prior to the competition, nearly 80% of the students had worked on an interdisciplinary group project. Of the 80% of students who had prior interdisciplinary group experience, nearly 60% of the students indicated it was a positive experience, while 20% indicated it was a negative experience. Of those who had a positive prior collaborative experience, many students responded that they had learned something from their team members that they did not previously know and gained a greater understanding of how another discipline works. When asked what their goals were for the competition, the results for all respondents were as follows:

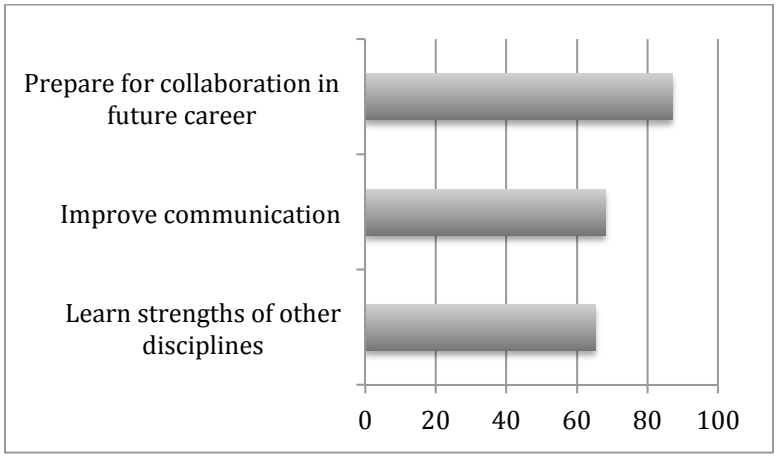

Figure 2: What are your goals for the competition?

To assess their impressions of IPD at the outset of the competition, the students were then asked what characteristics they believed were essential to successful IPD, the results of which are indicated in Figure 3, below.

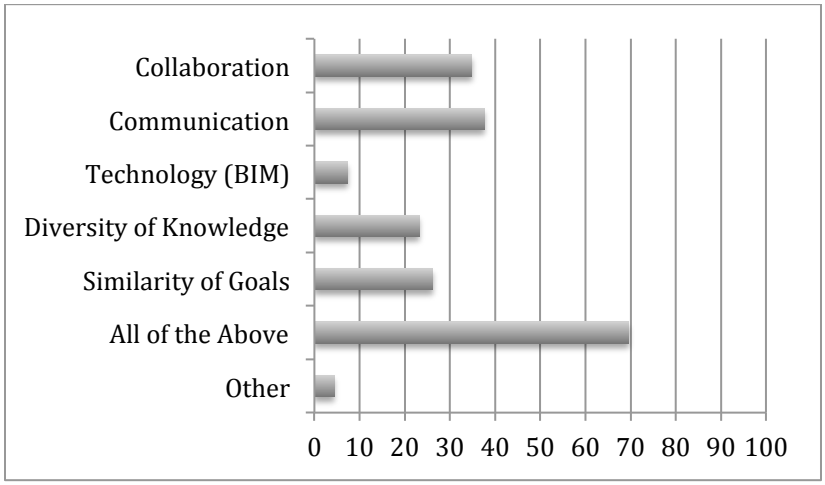

Figure 3: What characteristics are essential to successful IPD?

Additionally, the students were asked about their perceptions of the strengths and weaknesses of the other disciplines, based on prior experience and/or stereotype. This question was posed at both the outset and conclusion of the competition to determine if their perceptions of the disciplines changed as a result of the competition. A sample comparison of the initial and final results of the perceived strengths and weaknesses of the construction students is shown in Figure 4, below, and a sample comparison of the initial and final results of the perceived strengths and weaknesses of the architecture students is shown in Figure 5, below.

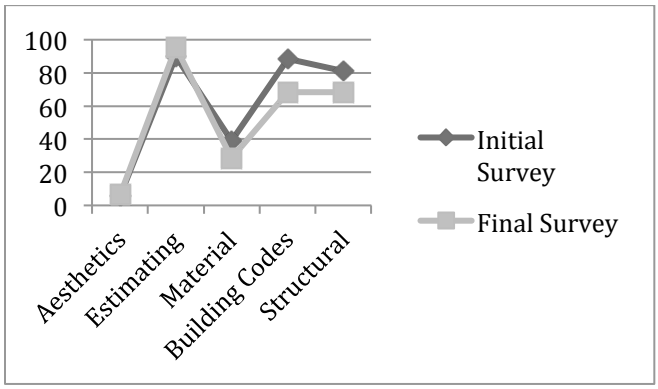

Figure 4: Comparison of the perceived strengths and weaknesses of construction students.

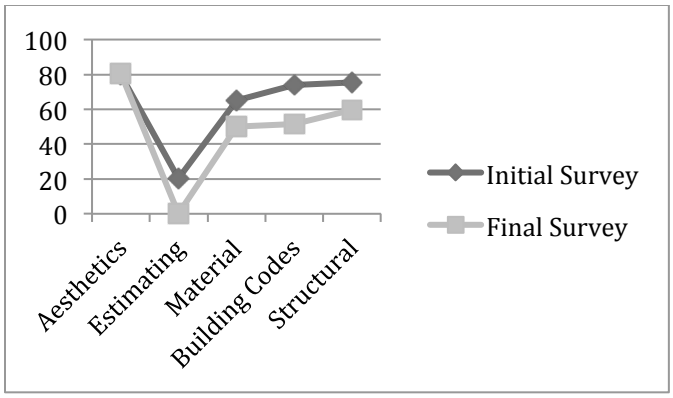

Figure 5: Comparison of the perceived strengths and weaknesses of architecture students.

It is important to note that the results indicated in Figures 4 and 5, above, are illustrative of the students' perceptions of the other disciplines throughout the competition. After working together for two weeks, there were slight changes between the perceived strengths and actual strengths reported at the end of the collaboration. Although it is difficult to discern the reason(s) for the slight changes, one possible explanation may be the fact that nearly 80% of the students had prior interdisciplinary experience, and therefore already had some understanding of the strengths and weaknesses of the other disciplines. The slight changes from the initial to the final surveys may result from the students working with the other disciplines in a new context that is challenging different skills than prior collaborative exercises have. Based on the short project duration, students may not have had time to fully explore the differences between their initial perceptions about the other disciplines in the context of the assigned project.

In order to assess the students' perception of how work would be divided among the disciplines, the students were asked which discipline(s) would be responsible for certain project deliverables, and at the conclusion of the competition the students were asked which disciplines were actually responsible for those same deliverables. The comparison of the initial and final responses is shown in Figures 6 and 7, below.

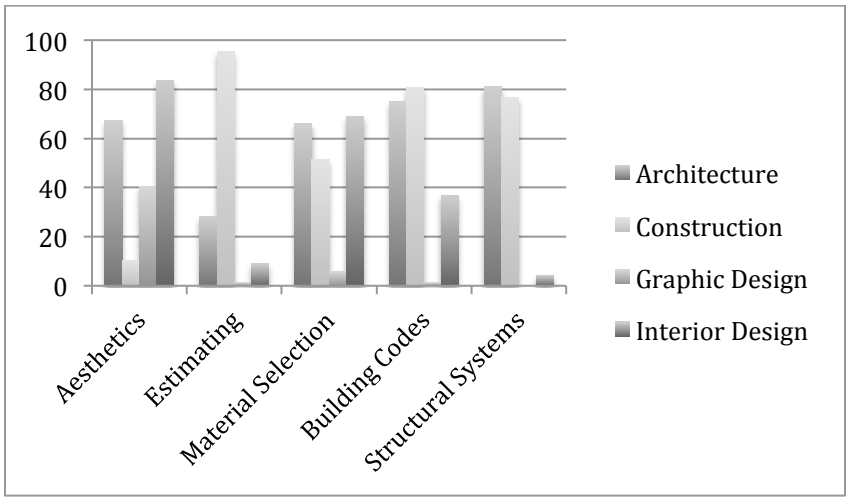

Figure 6: What discipline do you anticipate being responsible for the following?

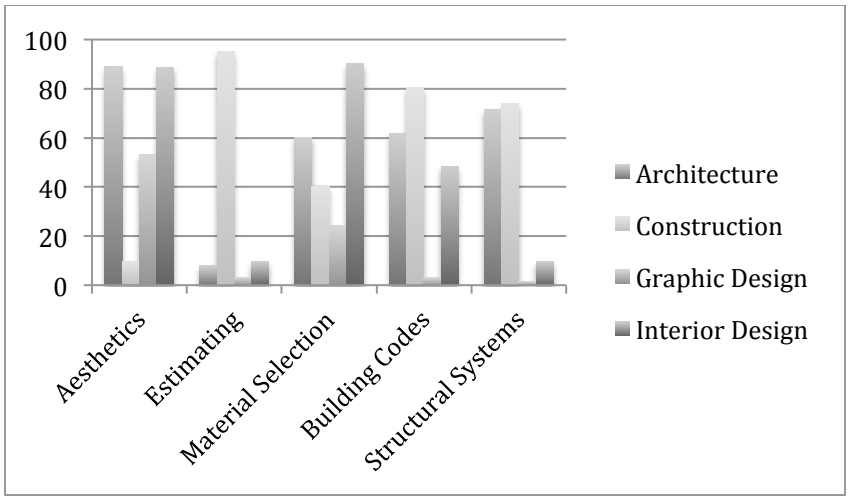

Figure 7: Which discipline was primarily responsible for the following?

The most significant changes between the pre and post surveys were with regard to which disciplines would be responsible for estimating, material selection, and building codes. In the initial survey, 28.36% of all respondents believed architecture students would be primarily responsible for estimating, whereas in the final survey, the percentage of respondents who believed architecture students were primarily responsible for estimating dropped to 7.94%. The largest change with respect to material selection was an increase from 69.12% to 90.32% in the discipline of interior design, showing that the discipline ultimately played a larger role in material selection than the respondents initially believed they would. Another change from the initial to final results was with regard to which discipline would be responsible for building codes. In the initial survey, 75% of respondents believed architecture students would be responsible for building codes, and 36.76% of respondents believed interior design students would be. By the final survey, only 61.9% of respondents believed architecture students were responsible for building codes, while the percentage of interior design students responsible for building codes increased to 48.39%. These results show that at this stage in their education, students in all of the disciplines may lack a thorough understanding of the other disciplines, and possibly even their own.

Several results from the final survey indicate that the competition was a beneficial experience for the students. Eighty-seven percent of the respondents indicated that their goals for the project were realized. When asked if they enjoyed the project, 49% indicated yes, because team members were able to contribute something they could not, while nearly 32% indicated yes, because the end result was something better than they could have obtained on their own. Although the project duration is brief, the fact that a combined 81% of the students indicated that they enjoyed the project, which was just one of many collaborative opportunities presented to the students in their respective curricula, gives them yet another opportunity to improve communication and other collaborative skills that will be necessary in their careers regardless of the types of project delivery methods they work under.

Prior competitions

2014 marked the fourth year of the annual design competition. Slight modifications have been made each year in order to improve the experience and outcome of the competition. Several key

factors have made a difference in both the student outcomes and perceptions of the experience: scope of the project, group formation, faculty input, and physical space.

Because of the short duration of the project, the faculty learned over the prior years to limit the scope of the project to a relatively small square footage. When presented with larger programmatic challenges, the students have become frustrated and overwhelmed because the short duration of the project only allows for the development of deliverables at a conceptual stage.

In prior years the faculty have also experimented with how the student groups are formed. The first year of the competition, faculty members randomly placed students in groups, with the primary concern being equal distribution of the disciplines among the groups. In the early years of the competition, there were a considerable number of personality conflicts within the groups, often revolving around one or more team members being perceived as dominating the group or, on the opposite end of the spectrum, not contributing to the group. This led faculty members to search for more effective ways to structure the groups. In 2014, when the groups were formed based on student input regarding personality and work habits, far fewer group conflicts emerged. One way in which this was done was by asking the students what type of group member they tend to be – the leader or the follower. Students were then placed with other like-minded group members – for example, the students who tend to feel they have to lead the group were placed in a group together, making them have to learn to work with other strong personalities. Similarly, students who self-identified as being more of a follower were placed in a group with other followers, therefore requiring one or more of them to take on more of a leadership role than he or she might have otherwise.

Another element that has been adjusted from the initial competition is how faculty members provide input throughout the competition. In an effort to ensure each group received feedback as the competition progressed, in earlier years the faculty members would split up and rotate among the groups. Students often expressed frustration about what they perceived to be conflicting advice from different faculty members. In response to this feedback, the faculty members decided for 2014 to all meet with each group at the same time. This allows students to observe dialogue among faculty members while also ensuring continuity when questions arise about project deliverables.

Although it may seem trivial, significant changes have been made to the physical space used to hold the competition. In prior years, the student groups have been dispersed throughout the architecture, construction and interior design studios while working in their groups. Because those studios are located in different buildings, it was difficult to address all of the students at the same time and in a consistent manner. Furthermore, it led to many students feeling territorial. For example, if students were working in the architecture studio space, the students from the other disciplines would often feel as though there was an imbalance in the group dynamic. In 2014 this issue was remedied by renting space in the student union so that all of the groups could meet in the same, neutral space.

Conclusion

Although educating students about the differences between IPD and other more traditional project delivery methods is seemingly straightforward, teaching the collaborative skills needed for IPD is difficult, especially when students lack the discipline-specific expertise upon which IPD relies. By engaging students in collaborative exercises, there is great opportunity for students to learn collaborative skills necessary for their careers. The more students are able to learn about the skills and strengths of the other disciplines, the earlier they can begin to establish trust and reliance in the other disciplines, a necessary skill for the collaboration they will face in their future careers.

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