

Educating Integrated Project Delivery Educators: A Study of the Source of IPD Knowledge Among Educators

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The focus of this paper is a survey conducted to determine how Integrated Project Delivery (IPD) content is currently being taught in undergraduate construction and architecture programs, and how it can be improved. Although there have been surveys conducted by construction educators to determine the presence of IPD education in construction programs, and similar studies have been conducted by architecture educators of architecture programs, the creators of this survey questioned whether those teaching IPD principles, in both construction and architecture, have first-hand industry experience with IPD projects. In order to improve the quality of IPD teaching, the survey further sought to determine which content areas IPD educators wish they were better positioned to teach, and what resources could improve their teaching of IPD. The results of the survey are being used to help the creators of the survey develop content for a symposium centered on improving the teaching of IPD principles in both construction and architecture programs.

Key Words: Collaboration, Integrated Project Delivery, Interdisciplinary, Project Delivery Method

Introduction

As educators we are aware of the changing trends in project delivery methods and understand the importance of preparing our students to be leaders in the industry. What we are sometimes less certain of, is how to effectively deliver content which we as educators may have little to no industry experience with. Integrated Project Delivery (IPD) is one example of this.

A recent study of labor productivity in the construction industry during the period from 1964-2012 reveals a decline in productivity of -0.32% per year over the 48 year period studied. This conclusion was reached by comparing the output of the industry with the number of work hours for each given year and adjusting for inflation. While the percentage does not seem significant for a single year, over a 48 year period the decrease is substantial, especially when compared to the 3.06% annual increase in productivity for non-farm industries during the same period. According to the study, one of the potential causes of this decline is the lack of collaboration in competitive project delivery methods such as design-bid-build. (Teicholz, 2013)

Twenty-five years ago, Design-Build was an emerging trend, accounting for approximately 15% percent of the construction market. Today, that number has grown to nearly 40%, with all 50 states enacting statutes that address Design-Build to varying degrees. Twenty-five years ago, there were no Design-Build courses offered in academia; today, there are more than one dozen degree programs specific to Design-Build, with countless individual courses being offered in architecture, construction, and engineering programs. (Halsey, 2014) Projects completed under the Design-Build project delivery method are reported to be completed 12% faster and cost 6.1% less than projects completed under the Design-Bid-Build delivery method. (Konchar, 1998)

While Design-Build has continued to grow in popularity in the past 25 years, it has faced competition in recent years from the newer project delivery method of IPD. While there are many similarities between the two project delivery methods, IPD tends to be associated with interdisciplinary collaboration and the use of Building Information Modeling (BIM) to a greater extent than Design-Build, leading many industry professionals to refer to IPD as

Design-Build on steroids. The American Institute of Architects (AIA) defines IPD as the leveraging of "early contributions of knowledge and expertise through utilization of new technologies, allowing all team members to better realize their highest potentials while expanding the value they provide throughout the project lifecycle." (AIA 2007)

The Associated General Contractors of America (AGC) on the other hand makes a key distinction between IPD as a project delivery method and IPD as a philosophy. AGC defines IPD as a delivery method as "a delivery methodology that fully integrates project teams in order to take advantage of the knowledge of all team members to maximize the project outcome. Integrated Project Delivery is the highest form of collaboration because all three parties (Owner, Architect, Constructor) are aligned by a single contract." (AGC, 2014) In contrast, IPD as a philosophy "occurs when integrated practices or philosophies are applied to more traditional delivery approaches such as CM at-Risk, Design-Build or Design-Bid-Build (where the Owner is not party to a multi-party contract)." (AGC, 2014)

Literature Review

In a 2001-2002 survey of member schools of the Associated Schools of Construction (ASC), a combined 83% of the 44 responding schools indicated that Design-Build was being addressed in the curriculum. However, as the study points out, assessing the quality of that Design-Build education is more difficult because 66% of the respondents address Design-Build as part of another course, while only 17% teach Design-Build as its own stand-alone course. By using the 2001 Molenaar study as a lens through which to investigate the unique aspects of design-build that distinguish it from traditional Design-Bid-Build, the study highlights "performance specifications" as being the most unique aspect of design-build. "Performance specifications" is defined to include: "the RFQ/RFP process, how RFP's are written and evaluated using performance criteria, how to prepare a response to an RFP, and how a design-builder is selected and evaluated in the marketplace." (Jackson, 2003). The results of the study show a staggering content coverage gap between stand-alone Design-Build courses and courses that integrate Design-Build into other courses. For example, 86% of stand-alone Design-Build courses address RFQ/RFP preparation, while only 12% of respondents who teach Design-Build as part of another course address RFQ/RFP preparation. (Jackson, 2003)

A later survey regarding trends in the Architecture, Engineering, and Construction (AEC) industry sought to determine whether changes were being made in construction management curricula in response to changing industry trends. Of the 43 ASC member programs to respond, 23 programs offered a stand-alone Integrated Project Delivery (IPD) course, with 18 of the 23 programs indicating the course was a requirement of the curriculum. Twenty-nine programs offered IPD content as part of another course and of those 29 programs, 21 indicated what percentage of the course focused on IPD, with one-third (7 out of 21) reporting that IPD content comprised 25%-50% of the course. Only one program indicated that more than 50% of the course content focused on IPD, while the remaining 13 (out of 21) responses indicated that IPD comprises less than 25% of the overall course content (more specifically, five reported IPD constituting less than 10% of the course content and eight reported IPD content comprising 10%-25% of the course content). (Johnson, 2009)

At the end of 2010, the Association of Collegiate Schools of Architecture (ACSA) and Autodesk® partnered to survey administrators at schools of architecture about the use of Building Information Modeling (BIM) and IPD in architecture curricula. With regard to IPD, the focus of the survey was how collaborative design strategies are being implemented in design studios. Of the more than 50 responses, 77% of respondents reported teaming architecture students with other architecture students at the same year level and 33% teamed architecture students with other architecture students at a different year level. Forty-seven percent of respondents reported teaming architecture students with students from other disciplines, however data was not gathered to assess which disciplines those students are from. Responses to another question indicated that when interdisciplinary collaboration does occur, it is most often with engineering however, the format of the question makes it difficult to distinguish whether that collaboration is at the student, faculty, guest critic, or instructor level. For example, it appears having an engineering faculty member serve as a guest critic at an architecture review could qualify as interdisciplinary collaboration under the survey, even though all of the students are from the discipline of architecture. Additionally, the survey asked how IPD is incorporated into the professional practice curriculum. The responses indicate that IPD content is

delivered predominantly in a lecture-based format centered around case studies. When polled about resources needed to facilitate teaching IPD, numerous comments mention the need for case study materials. (ACSA, 2011)

Because IPD is relatively new, for the time being IPD as a philosophy is being used with greater frequency, while IPD as a project delivery method is not used as often in its purest form. In a nine-project case study of IPD use in industry, researchers Ghassemi and Becerik-Gerber found that none of the nine projects studied embodied all six of the IPD characteristics identified by the study (early involvement, shared risk/reward, multi-party contract, collaborative decision making, liability waivers, and jointly developed goals). (Ghassemi and Becerik-Gerber, 2011) For each project studied, the parties involved picked and chose which IPD principles to implement on that particular project.

The survey further investigated barriers to implementing IPD and how to overcome them. One particular barrier is a cultural barrier, defined as "the unwillingness of the industry to vary from its traditional methods…" (Ghassemi and Becerik-Gerber at 40, 2011). One method for overcoming the cultural barrier is IPD training, which can be achieved at the organizational and/or project level. Organizational IPD training took place in four of the nine cases investigated. The training varied from company to company but generally involved employees attending training sessions about IPD methodologies, regardless of whether each individual employee was actively involved in an IPD project. In one case, the company owner asked employees to volunteer to undergo the IPD training, out of recognition that not every employee is a good candidate for the collaborative nature of IPD projects. (Ghassemi and Becerik-Gerber, 2011)

In contrast to organizational IPD training, project-level IPD training began after the project teams were formed and took several forms. In two cases the IPD training took place in three stages: a pre-design meeting where a consultant trained the team and facilitated the creation of a series of project goals and expectations, periodic meetings to ensure expectations were met, and a final meeting at the conclusion of the project to discuss lessons learned. In other cases, the project-level IPD training generally involved training team members about IPD principles and attending events and workshops where individuals and companies experienced in and/or pursuing IPD shared knowledge and experience. (Ghassemi and Becerik-Gerber, 2011)

Method

The overall goal of this survey was to assess the current status of IPD education in both construction and architecture programs at the undergraduate level. More specifically, the goal was to determine where faculty members responsible for teaching IPD principles derive their knowledge of IPD, what methodology is used to convey the material, and what resources faculty are lacking that could improve the teaching of IPD content. The purpose of collecting this data is to determine how to most effectively teach IPD principles. The methodology of the study was an online survey accessible via an e-mail hyperlink.

Participants

The focus of the study was initially targeted to be institutions that are members of the Architecture + Construction Alliance (A+CA) to evaluate whether interdisciplinary IPD education was occurring at those institutions. Due to the limited number of A+CA member-schools, the study was expanded to include institutions that are members of the Associated Schools of Construction (ASC), the Association of Collegiate Schools of Architecture (ACSA), the Building Technology Educators' Society (BTES) and the Society of Building Science Educators (SBSE). The e-mail containing the hyperlink to the survey was sent to the contact of record for the ASC member-schools and via the list server for ACSA, BTES, and SBSE. Because of the potential overlap in the list servers, it is impossible to determine the exact number of recipients, and therefore the response rate. However, the 31 responses received represented a dispersed geographical area with diversity among the demographics of the respondents, as discussed in more detail in the results section, below. Furthermore, the number of responses is not substantially different in number to the 44 responses in the Jackson survey, the 43 responses in the Johnson survey, and the 50 responses in the ACSA survey,

all discussed in the literature review, above. The graphic in Figure 1, below, shows the discipline and approximate location for each response received.

Figure 1: Responses by discipline and approximate location.

The Survey

Part 1 of the survey contained demographic questions regarding rank, institution, the number of years of both teaching and industry experience, and whether the participant has ever completed a project under an IPD or Design-Build contract. Part 2 of the survey contained questions regarding the nature and type of interdisciplinary collaboration and IPD education taking place at the institution. For the purpose of this study, IPD was defined to include Design-Build, IPD, and Integrated Practice (IP) because of the collaborative underpinning of each of these project delivery methods.

Results

Responses were received from 31 participants with nearly equal distribution between the disciplines of construction and architecture. Seventy-four percent of the respondents indicated that both construction and architecture programs are present within their institutions. Nearly 65% of respondents have 11 or more years of teaching experience and nearly 52% of respondents have 11 or more years of industry experience. Twenty percent of the respondents hold the rank of full professor, 43% the rank of associate professor, 27% the rank of assistant professor and 10% hold administrative roles. None of the respondents were adjunct or visiting faculty. Despite the high percentage of respondents with 11 or more years of industry experience, nearly 71% of all respondents indicated having never completed a project under an IPD or Design-Build contract.

With regard to the implementation of IPD principles in coursework, nearly 80% of respondents are already implementing IPD principles into coursework, yet when asked whether it is a requirement of the curriculum or optional, 85% of respondents indicated it was optional. Of those respondents who incorporate IPD principles into coursework, the primary means by which that occurs is in a lecture course (nearly 81%). Within those lecture courses, IPD content is delivered primarily through lectures and readings, with collaborative exercises and problem-based assignments being implemented slightly less frequently, as shown in Figure 2, below. Follow up interviews

are being conducted to determine the nature of the problem-based and collaborative exercises in order to better understand what the intended learning outcomes are for those exercises and how those exercises are assessed.

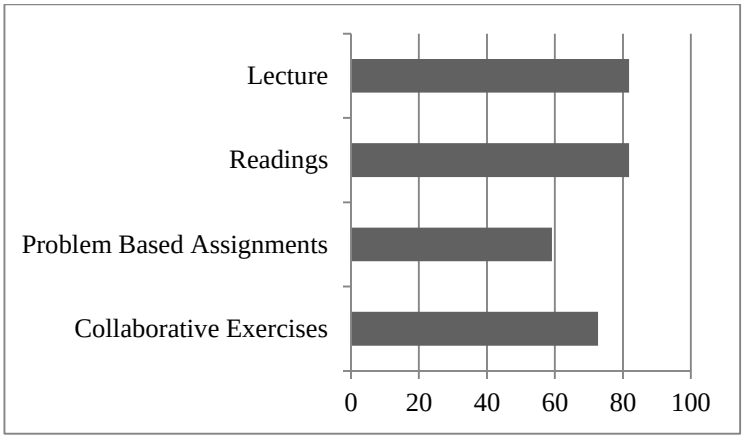

Figure 2: Which methods of teaching do you use to deliver IPD content? Select all that apply.

Respondents were also asked if their institutions offered any cross-disciplinary courses and if so, with which disciplines do they collaborate. Thirteen percent of the respondents indicated that no cross-disciplinary coursework exists at their institutions, while the remaining 87% of respondents indicated a presence of cross-disciplinary courses and indicated collaboration exists with the following disciplines:

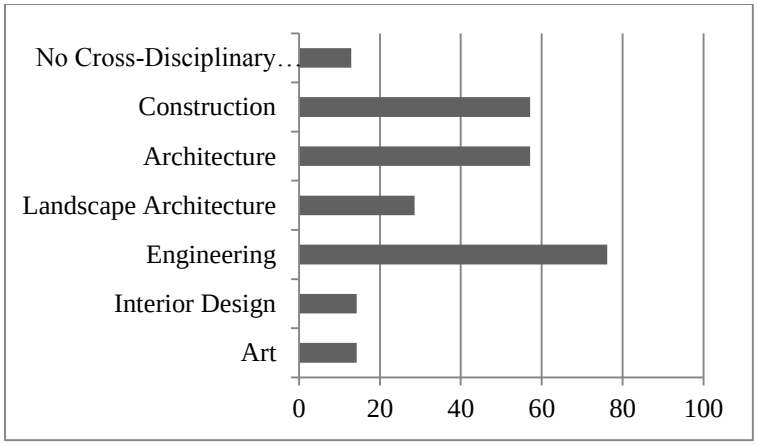

Figure 3: Please select the disciplines with which you tend to collaborate. Select all that apply.

In Integrated Project Delivery: A Guide, the American Institute of Architects (AIA) highlights six major areas in which traditional Design-Bid-Build and IPD differ: Team, Process, Risk, Compensation/Reward, Communications/Technology, and Agreements. (AIA 2007) These six topical areas formed the basis of a question asking respondents to select areas in which they wish they themselves had a better understanding so they could more effectively teach IPD principles. The responses were as follows, with more than half of all respondents expressing a desire for more knowledge of Risk and Compensation/Reward:

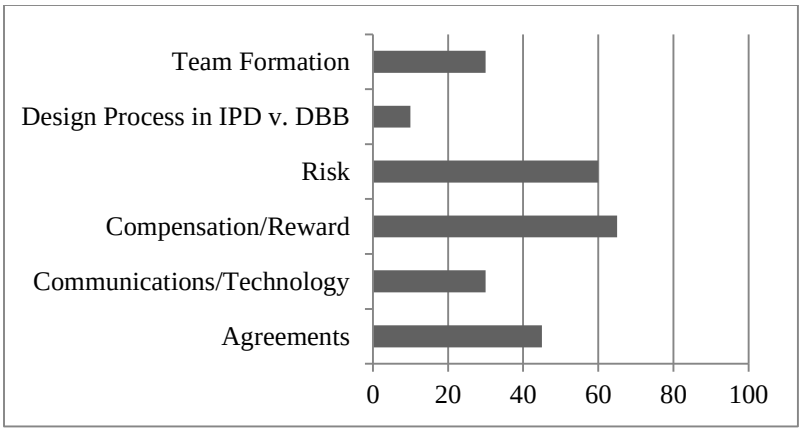

Figure 4: With regard to teaching IPD more effectively, please select areas in which you wish you had a better understanding.

Respondents were also asked to respond to a series of questions regarding the relationship between IPD as used in industry and IPD teaching/education, the results of which are as follows, with zero respondents recorded as neutral, disagreeing, nor strongly disagreeing:

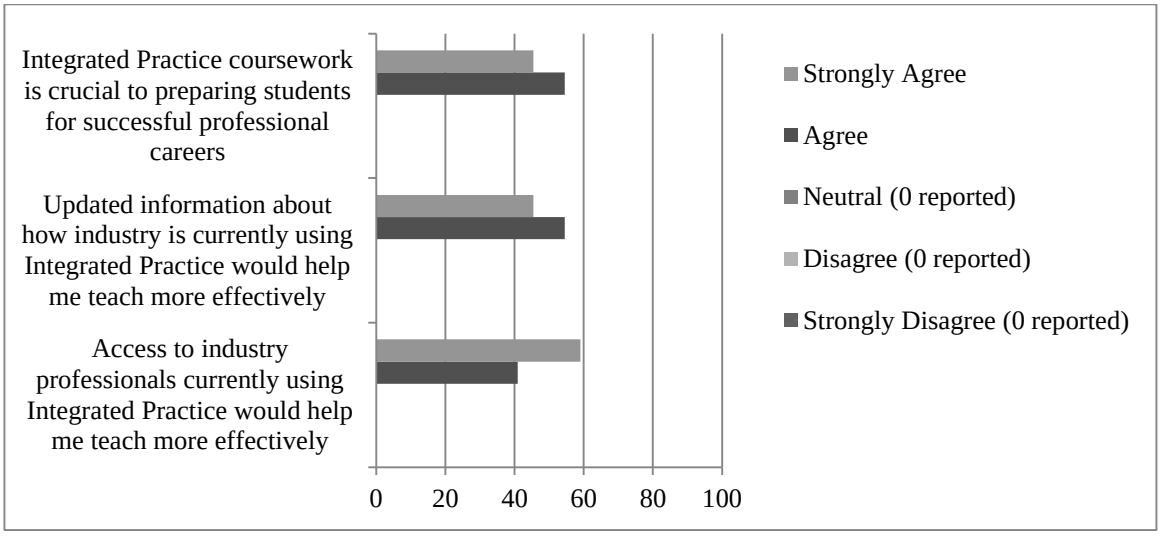

Figure 5: Please respond to the following statements.

Discussion

The findings of the survey confirm initial suspicions that the majority of educators recognize the importance of teaching IPD principles, because although 85% of respondents indicated that IPD coursework was optional, 55% of respondents agree and 45% of respondents strongly agree that IPD coursework is crucial to preparing students for successful professional careers. However, approximately seven out of every ten respondents lack first-hand industry experience with IPD projects. Given the lack of first-hand industry experience, the majority of educators are left to teach IPD principles with limited resources available. Case studies and readings explored in lecture courses appear to be the predominant teaching methodology with respect to teaching IPD. While there are plenty of books and websites explaining how the IPD process differs from traditional project delivery methods and the advantages and disadvantages of the various project delivery methods, the survey results indicate a desire for more detailed and up to date information regarding IPD. This is evidenced by Figure 4, above, where at least 60% of all respondents

indicated a desire for a better understanding of risk and compensation/reward, while less than 30% of all respondents indicated a desire for help teaching about team formation and how IPD differs from Design Bid Build with respect to the design process. Unfortunately, many case studies of IPD projects focus on team formation, in terms of who the key participants were, and technology, in terms of a digital model and how many clash detections were found by modeling the project. Risk and compensation/reward tend to be less frequently discussed but perhaps provide the most relevance for getting students to understand why IPD is important to them – what do they stand to gain and what are the risks in getting it?

With 60% or more of all respondents indicating an interest in learning more about risk and compensation/reward, while all respondents agreeing or strongly agreeing that both updated information about current industry trends in IPD would improve teaching, and access to industry professionals using IPD would improve teaching, at least two topical content areas have emerged as gaps in faculty members' knowledge. Stronger ties between academia and industry have the potential to fill these gaps. By drawing on industry professionals to supplement IPD content, students can be provided with a context for information presented to them. The opportunity to ask industry professionals questions about various aspects of IPD projects and get specific examples of how risk and compensation/reward were addressed on various projects can provide an invaluable learning opportunity for faculty and students alike.

Successful collaboration can occur in industry because each discipline is relying on the discipline-specific expertise of the other disciplines. In an undergraduate educational setting, that reliance can be problematic because students are not yet experts, nor should they be expected to be. Because the students are not yet experts in their respective disciplines, educators instead need to focus on modeling, teaching, and improving communication skills, especially among the disciplines. While it is important for students in all disciplines to have strong communication skills overall, interdisciplinary communication is an important aspect of IPD education. Contractors and architects have to work with each other and other professionals every day, despite often having different thought and decision-making processes and priorities. The earlier students begin to learn to collaborate and communicate effectively with other disciplines, the more effective IPD can be, both in academia and in industry. This is evidenced by slightly more than 70% of respondents using collaborative exercises in their IPD coursework, and 87% of respondents indicating the presence of interdisciplinary coursework.

Conclusion

The study performed by Ghassemi and Becerik-Gerber highlights the need for thorough and effective IPD teaching in academia. While it may not eliminate the need for IPD training in industry altogether, it would certainly help to better prepare students to enter the job market prepared to participate in, and contribute to, IPD projects. The study that is the focus of this paper reveals a need to focus on improving how faculty teach the IPD topics of risk and compensation/reward. With 70% of IPD educators lacking first-hand industry experience on these topics, the need for industry input on these subjects is essential to successful IPD education.

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