

An Analysis of the Demand for Interdisciplinary Curriculum Within the CAED

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This study serves to demonstrate the demand and benefits of interdisciplinary curriculum within the College of Architecture and Environmental Design (CAED) at California Polytechnic State University. While the literature review serves to highlight the unique learning benefits of interdisciplinary coursework, the survey demonstrates student demand for such courses across all colleges in the CAED. This study provides possible solutions to an existing problem within the CAED through the avenue of the construction management department.

Key Words: Cal Poly, interdisciplinary, Integrated Project Delivery, collaboration, coursework

Introduction

California Polytechnic State University belongs to a unique group of universities that have construction management, architecture, landscape architecture, architectural engineering, and city and regional planning programs all within the same college. Despite the trend of rising demand for collaboration between industries, no encompassing interdisciplinary courses exist within the CAED. Although in the past, Integrated Project Delivery minors were offered along with Integrated Project Delivery courses, we have taken a step backwards and removed both the IPD course as well as the minor from the Cal Poly curriculum. While opportunities exist for some students who actively seek them, curriculum does not provide an easily accessible avenue.

This step backwards has happened amidst a call from industry professionals to the academic community to focus on collaboration starting with college education. The lines have blurred incrementally between industries in the working environment, yet lines are still somewhat rigid within the CAED. According to ENR, students who enter the workforce having been exposed to a broader and more collaborative curricula will be far better equipped to handle the challenges faced in their careers (Penney 2016). Not only are industry professionals urging collaboration to start in the classroom, college students today are a part of the most connected and collaborative generation to date. Dealing with the generation at hand provides the perfect opportunity to break down existing silos between departments.

The aim of this study serves to demonstrate an unmet demand in the curriculum of the CAED, with a focus on the Construction Management department. The hypothesis examined in this study is that the majority of Cal Poly CAED students are interested in reviving these interdisciplinary courses to collaborate with other students of engineering, design, and construction in a studio environment. To properly assess the CAED student body opinion, a nine-question survey was sent out to all students of each college within the CAED.

The contents of this study include a literature review discussing the importance of integration and collaboration among project teams, a detailed description of the methodology used to research this problem, an analysis of the results discovered, final conclusions, and a recommendation to the Construction Management Department,

Literature Review

Integration of a project team can be defined as “where different disciplines or organizations with different goals, needs, and cultures, merge into a single cohesive and mutually supporting unit with collaborative alignment of processes and cultures” (Baiden 2006). In the built environment, each industry has their own specific goals. These goals can be broadly categorized into design, engineering, and construction. However, on a larger scale, every team is working towards the same goal, to provide the highest quality project and promote their respective companies. With increasingly complex and technical building demands, merging these goals and cultures into a single cohesive unit is more important than it ever has been.

In 2010, a study was conducted to evaluate the relationship between project team effectiveness and integration. Results showed that there was a direct link between integration and overall project team effectiveness. “Practices within the interviewed project delivery teams pointed toward very good levels of team integration with Projects E and G having the highest. Teamwork within these projects were also the most effective” (Baiden 2011).

Even in 1996, studies were being done comparing cost, schedule, and quality performance of Design Build vs traditional Design Bid Build projects. This study found DB projects improve delivery speed by 30%, construction speed by 12%, and unit cost by 13%. Although every project faces a unique set of challenges, these results are significant. Until 2013, no study existed which explicitly outlined the statistical benefits to a successful IPD project. Other than anecdotal success stories, there had previously never been any analysis done to prove reduced design time, cost savings, or rework through integrated project delivery. This study published by the Associated Society of Civil Engineers analyzes IPD on metrics of cost, time, quality, safety, changes, process inefficiencies, communication, and profit. Through analysis with a strict significance level, IPD was found to “have superior performance in metrics related to quality, communication, change performance... processing times, and significantly faster delivery times” (Asmar 2013). This trend of increasing integration is growing at an exponential rate as building technology advances.

As demand for integrated project delivery and collaboration continues to rise, it is important to understand how this relates to the academic world. As mentioned in the introduction, industry has recently made a call to the academic world to promote collaboration in college. The article expressing this request was authored by Thompson E. Penney and Ryan Abbot, co-chairs of the AIA-AGC joint committee. These industry leaders made a powerful and clear statement, “The bottom line is simple: Students who enter the workforce having been exposed to broader and more collaborative curricula will be far better equipped to handle the myriad challenges they will face, regardless of their chosen discipline. We ask that our partners in engineering and landscape architecture join us in making a similar call to the academic community. The future livelihood of the greater architecture-engineering-construction community depends on it.” (Penney 2016). This message from the AIA-AGC committee is a clear testament that Cal Poly has no time to waste. As other institutions begin to adopt more interdisciplinary programs, so should the CAED. The CAED is an extremely prestigious college which has only more to gain from adopting these programs.

In a periodical on the future of interdisciplinary studies, Dr. Ethan Kleinberg presents very important insight on the importance of integration, and the differences in two models of interdisciplinary studies. Without a doubt, the CAED is in an interdisciplinary college. However, the CAED has fallen subject to “the isolation of the market-driven niche majors”. Kleinberg explains the dangers of the desire for independence and control growing stronger than the intellectual goals of the interdisciplinary project. Kleinberg mentions two models to interdisciplinary studies. The second model is “project-based and brings multiple disciplines together to address a specific issue or set of issues...In turn, the traditional disciplines are brought into contact with each other not only through the interaction of scholars and students in the interdisciplinary projects but also through the return of these scholars to their “home” disciplines, where they can share these new ideas and approaches. Such exchange occurs when faculty are discussing ideas instead of competing for funding. The success of interdisciplinary departments, programs, and centers requires institutional support, but it also requires internal self-restraint so that they do not end up as ersatz disciplines” (Kleinberg 2008).

Methodology

To collect accurate information regarding the demand for interdisciplinary courses at Cal Poly, a survey was sent out to the entire College of Architecture and Environmental Design. The survey was designed to measure student opinions on specific aspects related to collaboration in the architecture, engineering, and construction industry.

The questionnaire contained nine questions total. Of the nine, two questions gauged the students major and class rank. The remaining seven questions consisted of one yes/no, four Likert Scale questions, and two free response questions. Of the 198 responses, 149 respondents left valuable free response answers.

While the main objective of the questionnaire was to measure interest in interdisciplinary courses and a potential minor, it was also designed to gauge opinions on the importance of collaboration in industry. Students were able to score their readiness to enter the workforce and collaborate on an integrated project team, as well as rank how important they feel an interdisciplinary course is to the CAED curriculum. Additionally, students were asked how well they feel that their curriculum at Cal Poly has prepared them to navigate being a part of an integrated project team upon entering the workforce. The final two free response sections allowed respondents to specify which classes they have taken so far at Cal Poly which promote collaboration between multiple majors, and to leave any comments that they have regarding the topic at hand.

After sending the survey out via email to each student in the CAED, 198 responses were received. Of these 198 responses, 17.8% were first year students, 18.8% were in their second year, 18.2% were in their third year, 24.3% were in their fourth year, 10.7% were in their fifth year, and 10.2% were graduate students. Furthermore, of the 198 respondents, 10.6 % were students of Construction Management, 41.6% were students of Architecture, 16.2% were students of Architectural Engineering, 12.2% percent were students of Landscape Architecture, and 18.3% were students of City and Regional Planning (For graphical representation of these statistics see Appendix A). When observing the characteristics of the response sample, two notable characteristics can be found. A disproportional number of respondents were students of architecture, and nearly a quarter of respondents were in their fourth year of school. Despite a high response rate from the school of architecture, the sample is healthy for evaluation.

The population of the CAED is approximately 1,823. Utilizing the sample size of 198 and a confidence level of 95, the data found can be assured with a margin of error of 7%.

The data was analyzed using the survey monkey program. While the yes/no question had clear results, other questions required further analysis. When analyzing the four questions which used Likert Scale, the mean was the most important statistic for determining results. Common themes and articulate answers were considered when analyzing the free response questions.

Analysis of Results

The following analysis will provide a detailed breakdown of the responses to each nine questions designed in the survey, the results which effect this study, as well as questions and comments prompted. Data summaries for the entire survey can be found in Appendix A.

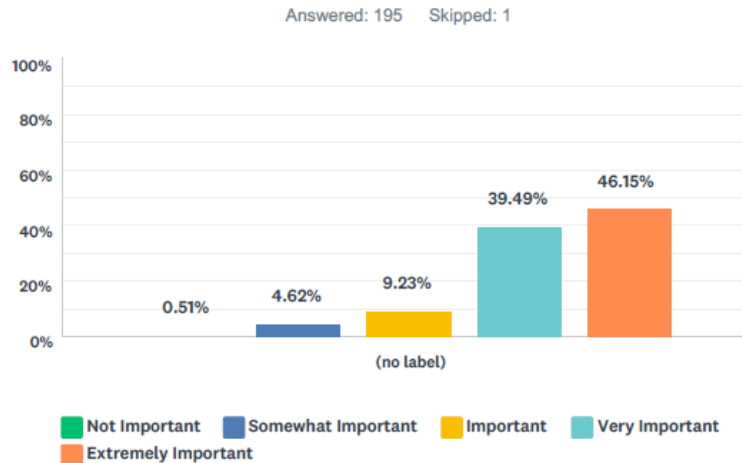


Figure 1: Response to Question 3: How important do you think integrated project delivery (or interdisciplinary work in general) is to the architecture, engineering, and construction industry?

This question served to set the tone for the remainder of the survey. This was a basic assessment of how important students at Cal Poly feel integrated project delivery, or interdisciplinary work in general, is to our industry. The respondents were given choices ranging from “Not Important” to “Extremely Important” which correlated to the Likert Scale of 1-5. The result was a mean of 4.26, 5 being extremely important. Additionally, only 0.5% of students felt that an integrate approach was not important to our industry. Even when examining the results by filtering responses by major, the results remained steady with a mean well above 4.0. This explicitly indicates that the majority of students, regardless of class year or major feel that integration is very important to our respective industries.

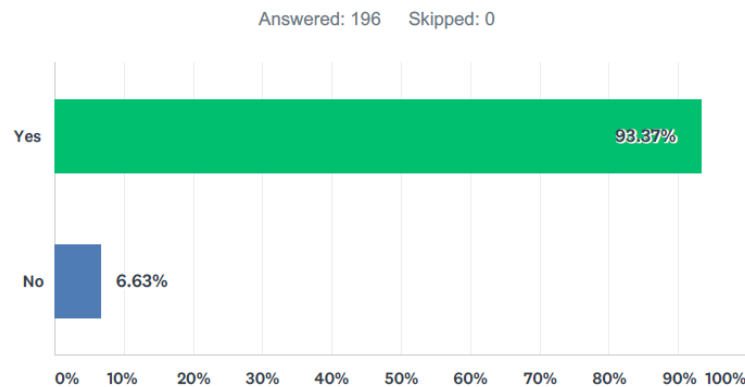


Figure 2: Response to Question 5: If given the opportunity, would you enroll in an interdisciplinary course involving students of architecture, engineering, and construction management?

Figure 2 demonstrates the most compelling results of the study. When students were asked if they would enroll in an encompassing interdisciplinary course, 93.37% of students responded yes. This demonstrates a strong desire for collaboration among the fields of architecture, engineering, and construction management, regardless of the student’s class rank or major.

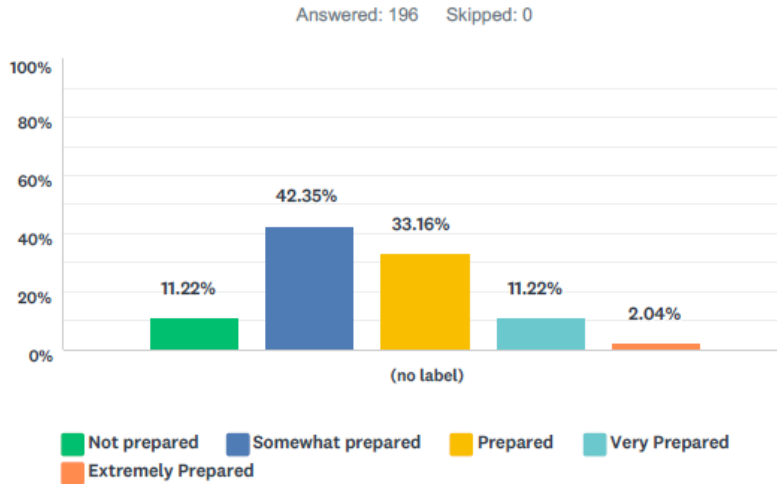


Figure 3: Response to Question 4: How well do you feel that the curriculum at Cal Poly has prepared you to navigate being a part of an interdisciplinary team?

Figure 3 demonstrates the results of student responses to Question 4. When asked how well students feel that their curriculum at Cal Poly has prepared them to navigate being a part of an interdisciplinary team, students responded more evenly across the board. This question also utilized a Likert Scale ranging from 1-5. The scale corresponded to provided answers ranging from “Not Prepared” to “Extremely Prepared”. The overall mean for the CAED was 2.5, demonstrating that most students feel generally prepared to handle being a part of an interdisciplinary team. To more properly analyze student preparedness, the responses were filtered to show responses from only 4th year, 5th year, and graduate students. When doing so, a similar mean of 2.48 was presented. Additionally, the results were analyzed using filters by major. Students of architecture responded with a mean of 2.55. Furthermore, 13.4% of architecture students feel either very prepared or extremely prepared to navigate an integrated project team. On the other hand, Construction Management students responded with a mean of 2.24, lower than the CAED average. Additionally, 0% of construction management students which responded to the survey feel very or extremely prepared to navigate an integrated project team (Complete survey data filtered to represent only Construction Management responses can be found in Appendix B). Architectural Engineering students responded with a mean of 3.03, demonstrating this group of students feels the most prepared to enter the industry.

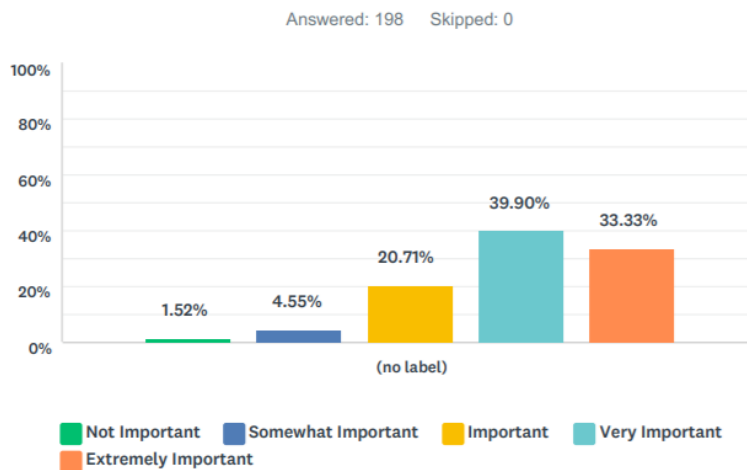


Figure 4: Response to Question 6: Considering your answers to the last three questions, how important do you feel that an interdisciplinary course at Cal Poly is for the CAED curriculum.

Figure 4 demonstrates the response to question 6, which asked students to score how important they feel an encompassing interdisciplinary course is to the CAED curriculum. Based on responses to questions 3 and 5, the responses are intuitive. Again, responses were measured on a Likert Scale from 1-5 (5 being extremely important) resulting in a mean score of 3.99 when analyzing the entire CAED. Responses to this question were constant across all departments, demonstrating importance to the demand previously mentioned.

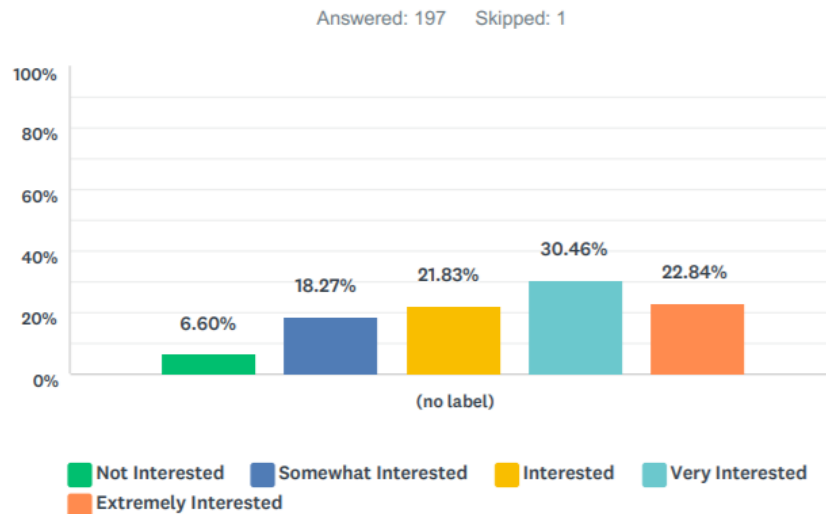


Figure 5: Response to Question 7: How interested would you be in pursuing an interdisciplinary minor within the CAED if one was to be offered?

When asked to gauge interest in pursuing a possible minor within the CAED, students responded with high interest. The results showed high interest in an interdisciplinary minor across the CAED. This question was evaluated using the Likert Scale of 1-5. With 5 being extremely interested, a mean of 3.45 was the final result.

When analyzing the free response questions, length of response and articulateness were taken into consideration. Highlights of student opinions have been provided below:

“I think Cal Poly needs to provide more interdisciplinary classes because that is the reality of the world. Work flow is different in interdisciplinary setting versus working alone. The depth of the project will also greatly change as the knowledge of different discipline comes together. In addition, it can be useful to understand and comprehend another's discipline while working on project. Thus, I think learning to work in an interdisciplinary setting is very important.”

“Please introduce interdisciplinary coursework! Making a successful career of any of these majors requires knowledge and experience with complimentary disciplines. Extensive interdisciplinary coursework would also facilitate much needed social and academic collaboration between otherwise isolated majors.”

“The interdisciplinary classes I have been involved in, such as alongside CM students, have not capitalized on the strengths of each major. It would be good to see more upper division, well-thought-out classes where students are able to apply their knowledge based on their background while working together.”

All other free response student answers and opinions can be found in Appendix A.

Conclusions / Recommendations

Literature review and research into industry perspectives demonstrates a strong niche for integration in the academic world. Collaboration between majors is more important now than it ever has been. If students of different backgrounds are expected to work harmoniously together after graduation, why not encourage collaboration throughout higher education. After careful design and analysis of a questionnaire tailored towards this gap in interdisciplinary courses within the CAED, backing has been developed for a recommendation to the Construction Management department.

Currently, the closest course to an integrated project delivery course in the Construction Management curriculum has been renamed to Integrated Design and Program Management. However, no students of design take this class, and it is geared specifically towards construction management students. Reviving the previous integrated project delivery studio course could provide students with great educational experiences and successfully fill a gap in our curriculum. With significant student interest in these courses, an interdisciplinary minor could gain more backing once again. Within the CAED, minors are the best avenue for promoting collaboration between multiple majors. The CM minor could act as a powerful tool in ensuring an even mix of students in such an interdisciplinary course. If students of Architecture, Architectural Engineering, Civil Engineering, etc. are required to take this course for their minor, it would ensure an empathetic environment in which students of design and engineering are interested in topics such as constructability and cost control. Furthermore, implementing such a course back into the curriculum for CMs as a tech elective would ensure that the college is not forcing any Construction Management student who is uninterested in collaboration to take this course. By reinventing the structure around such a valuable course, I believe much more CAED students would have an easily accessible avenue in which to collaborate with and learn from students of other disciplines.

Every study has limitations and difficulties faced. While survey results do not always accurately represent a population, the sample size recorded was significant enough to validate these recommendations moving forward. The CAED at California Polytechnic State University is an extremely prestigious college and adapting to industry trends is a strength of the Construction Management department. The implementation of a new IPD course would not only strengthen the curriculum of the CAED, it would effectively help in preparing students to work on collaborative project teams post-graduation.

References

- Asmar, Mounir El, et al. "Quantifying Performance for the Integrated Project Delivery System as Compared to Established Delivery Systems." *Journal of Construction Engineering and Management-Asce*, vol. 139, no. 11, 2013, p. 4013012.
- Baiden, B.K., Price, A.D., 2011. The effect of integration on project delivery team effectiveness. *Int. J. Proj. Manag.* 29 (2), 129-136.
- Baiden, B.K., Price, A.D., Dainty, A.R., 2006. The extent of team integration within construction projects. *Int. J. Proj. Manag.* 24 (1), 13-23.
- Jones, Casey (2010) "Interdisciplinary Approach - Advantages, Disadvantages, and the Future Benefits of Interdisciplinary Studies," *ESSAI: Vol. 7 , Article 26*.
Available at: <https://dc.cod.edu/essai/vol7/iss1/26>
- Kleinberg, Ethan, 2008. "Interdisciplinary studies at a Crossroads." Association of American Colleges and Universities, from http://www.eric.ed.gov/ERICDocs/data/ericdocs2sql/content_storage_01/0000019b/80/29/92/84.pdf.
- Penney, Thompson E., and Ryan Abbott. "Training in Collaboration Should Start in College." *ENR*, 20 June 2016, www.enr.com/articles/39694-training-in-collaboration-should-start-in-college.