Re-thinking Design Studio Pedagogy: Collaboration Between Architecture and the Allied Disciplines

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ABSTRACT: Building on research from the past two academic years and papers presented as a result of that research this paper is based on additional research and added variables to test the viability of collaborative studios between Architecture (ARC), Building Construction Science (BCS) and Interior Design (ID) students. The studios explored are based on three different collaborative methods. The first method is a three-week charette teaming students from ARC, BCS, and ID. The second method is a semester-long studio where collaboration was limited to ARC and BCS students who were physically separated and then came together for set assignments determined by the faculty. The third method pairs the first two methods to co-habitate the ARC and BCS students to encourage better collaboration in addition to modified assignments based on lessons learned from past collaborations.

The variables between each studio include number of studio iterations, collaboration time, co-habitation of each collaboration, varying faculty for each iteration, and year-level/experience level of the students. Consistencies on pedagogy from each studio were both preconceived and also developed over the length of the studio exploration and will be discussed in more depth and detail in the following paper.

The collaborations will be analyzed based on data collected from all prior collaborative studios. The three-week charette studio collected data via a variety of surveys conducted over the three weeks of the studio, which included both quantitative and qualitative data. The semester long studio will use data from two surveys conducted during the semester to gauge student perceptions and information learned. This data will then be consolidated to garner successes and failures to move forward into the third iteration of both studios to improve the collaboration for the upcoming studios, as well as future iterations.

KEYWORDS: building information modeling, collaboration, interdisciplinary, integrated project delivery, co-habitation

INTRODUCTION

> *"Students can no longer afford to work in sublime isolation from others, nor can faculty continue to ignore the essential interdisciplinary nature of architectural decision making." (*Boyer and Mitgang, 1997, 85)

While this quote from Allan R. Cooper, director of California Polytechnic State University- San Luis Obispo in 1997, is over sixteen years old, architecture education continues to struggle to achieve collaboration with the allied disciplines to teach our students the true interdisciplinary nature of architecture. The 2010-2011 BIM/IPD SURVEY RESULTS-SUMMARY conducted by the Association of Collegiate Schools of Architecture (ACSA) shows that while architecture programs are teaming architecture students collaboratively in relatively large numbers, this is not happening with as much success with students in the allied disciplines. (2011)

Also noticeable in this data from the ACSA survey is that Building Construction Science and other construction related disciplines are not mentioned as one of the non-architecture students and/or faculty that are part of these collaborative design strategies. This is especially concerning considering building contractors have slowly taken over the process of building from architects. There are many opinions as to why this is happening, but a prominent one is

the insulated and isolated world of architects, as noted by an architecture student speaking to Boyer and Mitgang:

> "*The field is turning too introspective and closing itself to clients and the other professions. That is why contractors are doing all of the building – no one wants to hear about the selfish interests of the architect. Schools should address this instead of perpetuating it.*" (Boyer and Mitgang, 1997, 111)

1.0. THE IMPORTANCE OF COLLABORATION

1.1. Integrated Project Delivery, Integrated Practice and Building Information Modeling

Collaboration with the allied disciplines is not just important to overcome the isolated nature and image of architecture, but also because of the evolution of the architecture profession and the development of ideas like Integrated Project Delivery (IPD), Integrated Practice, and the use of Building Information Modeling (BIM). Perhaps due to the recent dominance of building contractors in the built environment, architects are making the effort to take the lead on Integrated Project Delivery (IPD) and are the most experienced and informed of all AEC professionals in the definition and use of this important project delivery method (Kent and Bercerik-Gerber, 2010). However, the majority of architects who are using IPD, and are the most experienced with IPD, are AIA members that have been in practice for fifteen years or more. Principals are also the most frequently reported as having experience on an IPD project. Architecture education has a unique opportunity not only to teach our students how to collaborate with the allied professions, but also to increase the number of architects experienced in IPD by educating the younger generation of emerging architects.

1.2. Collaboration and IPD in Design Studios

Integrated Project Delivery (IPD) may have become the fastest growing form of project delivery since the American Institute of Architects (AIA) issued the first contracts referring to BIM in 2008 (Sabongi, 2009). There is no mention of IPD in the NCARB 2007 Practice Analysis of Architecture, and "Collaboration/Cooperation" is the 7th most important change wanted in the field of architecture at only 4.97%. However, the recently released NCARB 2012 Practice Analysis of Architecture shows an agreement between educators and practitioners on knowledge and skill sets important to IPD and BIM (2012 NCARB Practice Analysis of Architecture, 2013). This increase in significance has already been shown in architecture education through the recent 2010-2011 BIM/IPD Survey Results conducted by the ACSA.

The NCARB 2012 Practice Analysis of Architecture released in June 2013 gives more in-depth information on the importance of collaboration, IPD, and BIM. Educators, interns, and licensed architects were surveyed to gauge the level of agreement on the knowledge and skills that students were achieving during their education. The research gauged a wide variety of knowledge and skills that are needed to succeed as an architect, but this paper is focusing on the knowledge and skills that relate to collaboration, IPD, and BIM. The data shown below, from the Education section of the report, notes that there is disagreement on whether this information is actually introduced during architecture education. However, it does not discuss the importance of introducing the information.

Another area of the Education section of the *2012 NCARB Practice Analysis of Architecture* delves into the knowledge and skills that educators and practitioners think architecture students should achieve. It is broken down into areas of understanding and application. Select data from this report shows that over 50% of architects and educators agree on the importance of the understanding of certain knowledge and skills such as different project delivery methods, the roles, responsibilities and authorities of project team members during construction, and building information modeling (BIM) and its impact on planning, financial management and construction documentation.

These results show the importance of knowledge and skills relating to collaboration, IPD, and BIM to both the practice and academe. Also noteworthy is that educators tend to rate these areas of knowledge and skills as more important than do the practitioners. This is an important

development showing how educators understand the need to prepare architecture students to collaborate in the profession.

Additional results of the *2012 NCARB Practice Analysis of Architecture* are that more than 80% of practitioners that completed the survey feel that "collaboration with stakeholders is important, very important, or critically important." Educators note that collaboration is included in their program, with a response of over 50%, and 70% of educator respondents noted that students worked collaboratively with either guidance or feedback from faculty, or collaborated independently (Fig. 1). Nonetheless, interns surveyed reported a lower level of collaboration at only 31.5% which shows a gap in how interns and educators perceive collaboration in education. (2012 NCARB Practice Analysis of Architecture, 2013)

EDU TASK #	TASK STATEMENT	EDUCATORS		INTERNS WHO COMPLETED IDP WITHIN THE PAST 2 YEARS / ARCHITECTS LICENSED IN THE PAST YEAR	ALL LICENSED ARCHITECTS
		TASK IS COVERED IN PROGRAM	TASK IS PERFORMED BY STUDENTS	TASK WAS PERFORMED BY COMPLETION OF DEGREE	IMPORTANCE RATING 0 1 2 3 4
64	Collaborate with stakeholders during design process to maintain design intent and comply with Owner requirements.	55.6%	70.8%	31.5%	2.46
0 = Of little or no Importance 1 = Somewhat Important 2 = Important 3 = Very Important 4 = Critically Important					

Figure 1: Collaboration Data Chart from 2012 NCARB Practice Analysis of Architecture Report. Source: (2012 NCARB Practice Analysis of Architecture, 2013, 48)

In addition to this quantitative data gathered by the survey, qualitative data was also gathered by asking three open-ended questions. The three questions were:

> " How do you expect your job in the field of architecture to change over the next few years?"
> " What tasks will be performed and what knowledge/skills will be needed to meet changing job demands?"
> " If you could change the field of architecture, what is the most important change you would make?"

The first two questions garnered 1,485 responses which among other things noted an increase in the use of BIM and IPD, as well as "the need for better interdisciplinary collaboration with clients and contractors…" (2012 NCARB Practice Analysis of Architecture, 2013, 65) The qualitative data also collected information on how architecture education could help educate students based on how the role of the architect is changing. Collaborative work in design projects and especially in the earlier parts of the various project phases was an important item noted, as well as the establishment of "a more collaborative relationship with other professionals earlier in the design and construction phases." (2012 NCARB Practice Analysis of Architecture, 2013, 66) Additionally, skills noted by respondents as needed in the future included the formation of "clearly defined roles and responsibilities for members of a design and construction team." Respondents felt that this could help control project outcomes better than current practices. Notably, these ideas are integral to IPD and its use of collaboration and BIM.

Building construction education programs have not been as successful as architecture programs in implementing IPD and BIM into that curriculum. A survey by Farid Sabongi found that 62% of respondents feel that BIM education in undergraduate construction curriculum is inadequate. This is despite the data that shows that 75% of respondents to the survey think that BIM will increase in the marketplace over the next five years. Additionally, only 10% of building construction programs are addressing BIM in any way (Sabongi, 2009). IPD,

Integrated Practice, and BIM can be used as tools to help architecture students learn how to collaborate with the allied disciplines, while also being prepared to enter the profession with important skills that will help the profession develop in the future.

2.0. THREE STUDIO STRUCTURES

2.1. Three-Week Charette

This project has been conducted in the Fall semester of the past three academic years. The first year teamed fourth year students from the ARC, BCS, and ID departments to create a new town hall, library, and fire station for the town of Smithville, MS that was devastated in the tornados that hit Alabama and Mississippi in April 2011. The second year of the charette again teamed fourth year BCS and ID students, but this time with third year ARC students. The project was the sustainable renovation and redesign of a graduate student multi-family housing community on campus built in the 1960s. The third year, completed this past Fall 2013, was a much smaller project for the design of an infill lobby in a practice facility for the tennis team on campus. However, it did go back to the structure of all fourth year students from the three allied disciplines.

The organization and duration of each year was slightly different in that the first and third years of the charette were only two weeks long, and the second year was three weeks in length. Also, the charette did not start with the first day of classes in the first year, but instead had ARC students create a design that then the BCS and ID students had to accept and adapt to. This was seen as a deterrent to collaboration and IPD so the next two years began the project on the first day of class and all students were involved in the development of the project solution from the beginning. The makeup of each collaborative group varied each year based on enrollment in each of the department studios. However, ARC students continue to dominate the groups due to larger enrollment than in the other two departments. BCS is second in enrollment dominance but teams are usually divided to have one or two BCS students depending on the enrollment difference with ID.

Due to the varied faculty, project organization, and project types over the past three iterations of the charette a core group of faculty has emerged and decided to set standards for the charette to maintain more continuity for the sake of the research on the collaborative value of the project. The standards developed include:

- Set square footage range to keep the project size consistent
- Project duration pending project size and academic schedule, but no shorter than two weeks and no longer than three weeks
- Final project reviewers to include the project client, and the charette sponsors Brasfield & Gorrie General Contractors, but no faculty
- Student year will stay fourth year for all involved departments
- Speakers and experts on collaboration, IDP, and BIM will come present to students as part of the charette
- Team selection will include student-on-student interviews, skills to contribute to the team, and personality tests to develop a better team dynamic and to overcome the social issues inherent in bringing together such diverse professions
- Final presentation will be organized into a “gallery-style” presentation where reviewers walk around and informally speak to each team, while the faculty will choose the three strongest teams and they will present formally, as was done in the second year of the charette. This allows all students to receive feedback but gives the students time to see the strongest projects and to hear feedback from reviewers on a project other than their own. Similar to traditional design studio reviews.
- All students will be encouraged participate in research surveys, unlike this past year where faculty not involved in the research discouraged students from participating
- All faculty involved in the charette will meet with each student group as a team to avoid being unfamiliar with the designs of their specific students and to avoid contradictory or incorrect information.

Since this project is the longest running of the three studio structures, most of the best practices have come from these experiences. Conversely, since the duration of the project is so short the structure of the project for each studio must vary accordingly.

2.2. Limited Collaboration

This studio actually began in Fall 2011 when only second year ARC students participated in what was then called the "Tectonic I Studio." This studio was to be the pilot for the ARC department to see if information taught in two lecture courses, Assemblages and Materials, could instead be taught in a studio course. The studio was also to be developed and piloted the next year to include BCS students to work collaboratively with the ARC students since the BCS students shared at least one of the lecture courses, Assemblages. The second semester of this studio was termed "Tectonic II Studio" and was also meant to supplement information from the two lecture courses of Assemblages and Materials, and prepare ARC students to work with BCS students in the next year. The difference between these two studios was that the second "Tectonic II Studio" was for third year ARC students and was comprised of a larger scale project that included masonry and steel. The "Tectonic I Studio" was to cover all materials since it replaced the above mentioned lecture courses, but it was determined that there was too much material to cover and that the lecture courses were still needed to give the students a basis in which to come to this studio to complete the collaborative work.

The second year of the "Tectonic Studios" became a pilot of how to have the ARC and BCS students work together collaboratively. While the tectonic aspect of the studios still remained, it was obvious to the faculty that the tectonic was no longer the focus, but instead the collaboration. Both studios included second year BCS students, but the Fall 2012 semester included second year ARC students and the Spring 2013 semester included third year ARC students. This created an additional set of issues in that the students were not only culturally incompatible due to different ideas on work ethic and studio culture, but also incompatible in knowledge, maturity, and studio experience. Therefore, the two studios for the Fall 2013 and Spring 2014 semesters are pairing ARC and BCS students up by year with second year ARC students working with second year BCS students and third year ARC students working with third year BCS students.

This second iteration in Fall 2012 and Spring 2013 also limited the students to separate studio spaces and only a handful of collaborative assignments. The faculty had not successfully collaborated themselves in creating the assignments and the studio structure to allow both sets of students to truly feel invested in the studio. This is an especially important problem, based on the issues seen in the charette project discussed above, but also due to lower enrollment of BCS students in relation to ARC students. The BCS students are always outnumbered. Therefore, the ARC and BCS faculty worked together this past summer to create assignments and studio structure to try to overcome the isolation of the BCS students and the domination of the ARC students. This was done through a variety of assignments where either BCS students or ARC students take the lead based on the skills and knowledge that are specific to their field. Since the students are working in teams the students in the opposing field still must participate in the assignment and they then learn more about the skills and knowledge of their peers and the allied profession.

2.3. Co-Habitation

This academic year is the first year of fully integrating the collaborative studio with a tectonic focus. As mentioned above, the "Tectonic Studio" has been renamed the "Collaborative Studio" with a restructured focus on collaboration, while still allowing students to develop and understand the tectonics needed for their knowledge level. Currently, the second year ARC and BCS students are working on the design and construction of a bus shelter for the Mississippi Choctaw Band of Indians in Choctaw, Mississippi. The students all work together in one studio space and are divided into teams of four with three ARC students and one BCS student. But, again due to enrollment issues, there is one team of three BCS students and two ARC students. Assignments began as team designs for the bus shelter, which the faculty quickly learned alienated the BCS students since they had never designed something before. Yet, when the next assignment was introduced and should have been dominated by the BCS

students due to the construction, budget, and scheduling aspects, the BCS students again lagged behind their architecture counterparts.

While the studio is ongoing, the faculty consistently meet and evaluate the studio assignments and structure and reassess and restructure as needed. More individual assignments were created based on the cultural conflicts that arose between the ARC and BCS students who have very different work ethics and ideas of what studio should be. Despite this teamwork is still necessary as only two bus shelters are ultimately being built and there are forty-nine students in the studio. More development is needed to continue to help the BCS students adapt to what is still a foreign concept to them, while the ARC students need to learn to let the BCS students take the lead on more assignments and tectonic issues. All of this is also being assessed for the upcoming collaborative studio between the third year ARC and third year BCS students in Spring 2014.

3.0. METHOD AND DATA RESULTS

3.1. Three-Week Charette Method and Data Results

The data collection of this charette has not been very consistent, as noted with the development of the project itself. The first year consisted only of paper form surveys given at the beginning and end of the charette. The survey from the first year was developed more and digitized into an online survey what was conducted not only at the beginning and end of the charette, but also at two additional intermediate points during the charette. This was done with the collaboration of a Psychology professor who not only helped

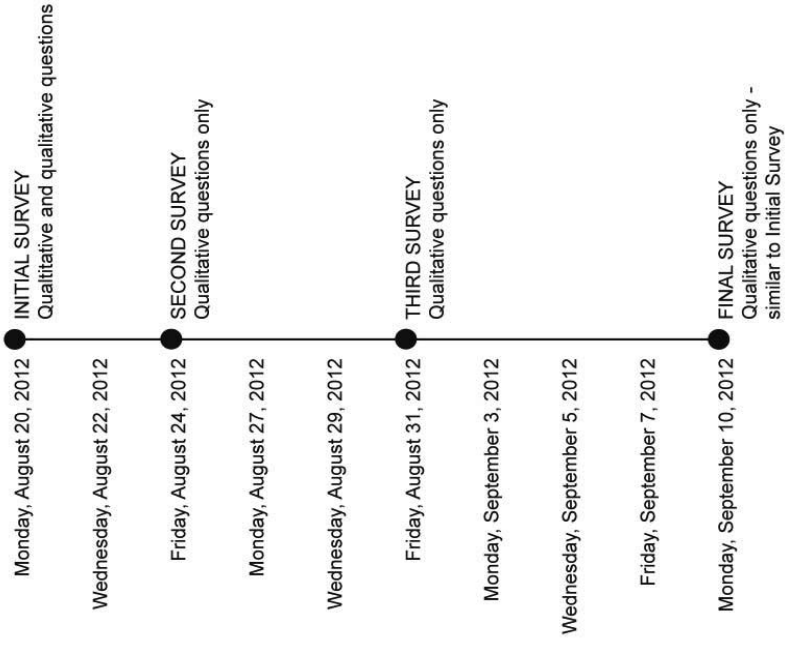

Figure 2: Timeline of Survey Distribution Fall 2012. Source: (Author 2013)

refine the survey, but also helped with qualitative and quantitative data collection and analysis. The extended three-week period of this charette also allowed more data to be collected because there was more time for the total of four surveys. In spite of this, the new faculty conducting the charette this past Fall 2013 decided to limit the charette back to two weeks, which limited the data collection to three surveys instead of four. Those surveys consisted of the pre-survey, intermediate survey, and post-survey. The surveys were done typically at the end of each week, but sometimes varied due to national holidays that precluded the gathering of the studio. (Fig. 2)

The surveys were developed to collect demographic information from the students as well as their perceptions of IPD and collaboration before, during, and after the charette. Qualitative data analysis based on the similarity of team members on responses to the question “What is your understanding of integrated practice?” showed that for teams where their initial responses were similar the final responses did not change much in relation to similarity. However, for the teams where their initial responses differed more their final responses had a much higher agreement in what integrated practice means. This shows that those teams who had different ideas of integrated practice possibly ended up having similar ideas on integrated practice as they learned more about it and their teammates in allied disciplines. Moreover, the teams that were more successful in the execution of their final project were no more similar in their agreement on integrated practice than those teams that were less successful. This shows that while the project development may not have been successful the students did learn more about working collaboratively and agreeing more on ideas like integrated practice by working with their teammates. (Fig. 3.)

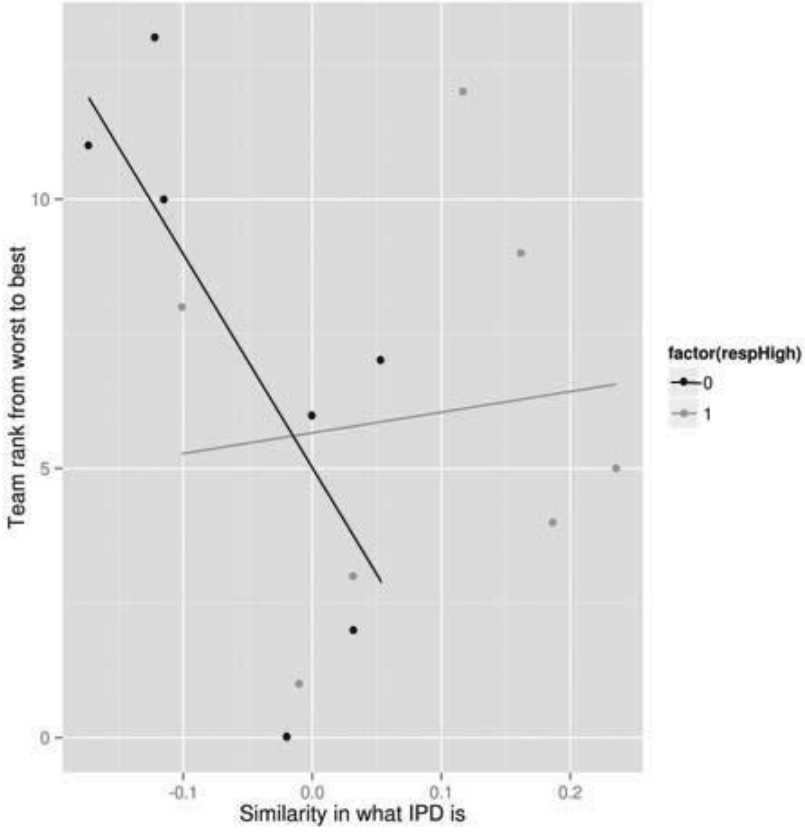

Figure 3: Chart of Agreement Amongst Team Members from Initial to Final Survey. Source: (Jarrod Moss, 2013)

3.2. Limited Collaboration Method and Data Results

This studio had limited data collection partially because this was a pilot studio where true collaboration was not the goal, and partially because of lack of collaboration on the part of the faculty in ARC and BCS. Collaboration between the three ARC faculty was very good as the faculty were well organized and had a similar pedagogy and idea of what the studio should be. The BCS faculty member also had a similar pedagogy and ideas to the ARC faculty, but was placed into the studio at the last minute so had no history of developing the studio for collaboration. This created a lot of chaos and misunderstanding in the collaboration between

the two departments despite the collegial relationship between the various faculty. The two research instruments were a survey/analysis of the collaborative aspect taken by both BCS and ARC students at the end of the semester, as well as a self-evaluation/team evaluation taken by the ARC students only half way through the semester.

All data was qualitative with open-ended questions asking the students to provide comments about the teamwork. The self-evaluation/team evaluation was for the preliminary project research that the ARC and BCS students completed together during the first half of the studio. This work consisted of research into building code and zoning, ADA and egress, LEED, site influences, project precedents, demographics, program, and construction specific issues. It also included teamwork on the design and creation of a physical site model, Revit site model, and studio booklet documenting all of the information gathered as part of this research. The survey/analysis of the collaborative aspect at the end of the semester included questions asking what the specific student learned and/or taught their team member from the other department, as well as any issues with teamwork, decision-making, and dependability.

Comments from the first evaluation taken only by the ARC students showed an inconsistency in skills and knowledge of technology, such as Adobe Creative Suite, as well as an inconsistency in knowledge of building codes, zoning, ADA and egress. The faculty believe this was due to the different year levels of second year BCS students working with more experienced third year ARC students. This issue should be addressed by having all third year students working together in Spring 2014. Another issue that arose from the comments was the inconsistency in studio culture and work ethic of ARC students and BCS students. This was noted on the comments from the final surveys as well. The ARC students are used to working nights and weekends in pursuit of a more developed and perfected product, whereas the BCS students are not even very familiar with the studio concept and are catching up with their ARC colleagues in that respect. This will also be remedied by having the students from the same year working together, but cultural differences between the two fields still exist even in higher education.

2.3. Co-Habitation Method and Data Results

No data has been collected from this studio yet since it has yet to be completed, but course evaluations at the end of the studio will be used to gauge the response of the students in the second year collaborative studio. The Spring 2014 studio will use the same midterm survey and final survey as last year to assess changes from the previous studio that had limited contact.

CONCLUSION

The data from the various studios show similarities despite the many variations in the studios. First, that the students in all departments must have similar knowledge and skill sets to make communication and collaboration possible. Second, that co-habitating students improves collaboration because the students spend more time together and therefore learn from each other more. This leads to better collaboration. However, how do you define “better” collaboration? The data from the longest running studio, the two-to-three-week charette, shows that even with less successful design projects the students were more successful in converging their ideas and understanding of collaboration, and the skills and knowledge of their colleagues in other fields. Time will tell if this remains consistent throughout the other collaborative studios.

The largest obstacle seems to be the cultural differences between the allied disciplines. This is not limited to academia, but is also prevalent in the profession. The most important thing that the professional and educational aspects of IPD share and must address is the importance of relationships and the barriers created by the social constraints of the allied professions. Deutsch reminds us of that fact when he quotes the GSA’s Charles Hardy in his article “Notes on the Synthesis of BIM”. Hardy is famous for stating “BIM is about 10% technology and 90% sociology,” and Deutsch reiterates that we must focus on the social aspects of integrated design (Deutsch, 2010). Understanding the evolution of the world-views of the stakeholders in building design and construction is also important and Ryan Smith analyzes this in his article “Socio-Technical Practices.” Smith posits that the various parties involved in construction have

diverged since the Renaissance, with disastrous consequences. This is further exacerbated by traditional construction contracts, which focus on winning the project instead of creating the best product possible. Defining the knowledge and resultant boundaries for each profession is important to overcoming this long-established barrier to an efficient and well-constructed project (Smith, 2011). This is also important to a successful collaborative studio to help the students understand not only their abilities and limitations, but also those of their partners.

These studios attempt to emulate these issues to help our students not just learn to collaborate but also understand their colleagues in the allied professions. The development of studio culture in building construction science and other allied professions where this is absent is one step to help our students work together in an atmosphere of equity and understanding. While not every program is interested and open to this we are seeing more and more success in the BCS students who are being taught similarly to the ARC students so that they can overcome their cultural differences. Further research and development of these studios is needed to test these ideas and eventually include other allied professions such as landscape architecture and engineering.

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