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Construction Students' Perceptions on a Studio-based Model, A Case Study

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A Studio-based learning model is a common instructional model in architecture, art, and design-based programs. The features of this type of learning model are attracting the attention of educators in many disciplines including construction education. However, applying this educational model in the field of construction is still new and needs more investigation and assessment. One key way to evaluate the effectiveness of this model and to inform ways of improving it is accessing students' perceptions where it is currently being practiced. The main objective of this study was to explore how construction students perceive a studio-based model in the curriculum. A quantitative research method was designed and employed to identify challenges, potentials, and the importance of an existing studio-based model approach. A group of senior construction management students at Cal Poly, participated in this study in the Spring of 2019. The results indicated an enhanced opportunity for the class to work and learn together through teamwork, collaboration, and group discussion was a significantly positive studio-based outcome. Student perceptions were also analyzed on a studio-based models' effectiveness, optimization, and learning. The results of this study can be used as a framework for preliminary design and implementation stages of a studio-based learning model at other universities and enhance ones currently using it.

Keywords: Project-based Learning, Construction Education, Student Perception, Studio-based Model

Introduction

A studio-based education model at the university level is acknowledged by most as an effective way to engage students in inter-professional education and project-based learning (Shraiky & Lamb, 2013). The application and benefits of inter-professional education, through project-based learning, in a studio-based model environment is strived for by many university professional degree programs. Unfortunately, this three-pronged educational approach is rarely obtained due to many factors including the unique physical space requirements, the holding on to traditional teaching styles, and the lack of resources available to implement what is admittedly a challenging teaching approach. Of all the professional degrees taught across the nation, construction education might need these three models employed the most. Construction industry advisory boards and construction students purport, through published work, the benefits of learning in a studio-based model (Rokooei & Hall, 2018; Rokooei & Ford, 2019). Striving to implement an integrated project-based approach to teaching in construction education has been well documented (Barlow, 2011). Organizations such as the

Foundation for Interdisciplinary Studies (FIS) solely exist to encourage inter-professional education and collaboration amongst students in AEC and related degree programs (FIS, 2019).

The "core" construction management courses taught in the Construction Management Program at California Polytechnic State University attempt to bring these three models together in a variety of ways. All the core courses are physically taught in a studio-based model classroom, they are project-based typically with an overarching assignment incorporated into the class, and attempt in a variety of ways to make the course inter-professional either with professional speakers, interdisciplinary student engagement, and/or role playing by the students themselves. This paper focuses on the studio-based model aspect of the students experience with these core courses, of which they take seven in the program, including:

- CM115 – Fundamentals of Construction Management
- CM214 – Residential Construction Management
- CM313 – Commercial Construction Management
- CM314 – Heavy Civil Construction Management
- CM411 – Specialty Contracting Construction Management
- CM413 – Jobsite Construction Management
- CM450 – Integrated Program Management

All seven courses are taught in the quarter system and are 5 units; two activity units and three laboratory units. The courses typically meet four days a week for three hours a day for a total of 12 contact hours a week. This is by far more in-class contact hours than any other class a construction management student will take at the university. These core courses are physically taught in a studio designed classroom with typically no more than 26 students in the classroom. The setup includes a lectern area, a traditional central lecture class gather space that doubles as a joint team/group work area and is surrounded by individual desks and kiosks which are assigned to each student for the entire quarter. A studio-based educational model is becoming the subject of great interest to construction management programs across the nation. There are currently two studio-based construction programs in the US – Cal Poly and Mississippi State. This kind of studio-based model combined with an inter-professional education and project-based learning has allowed students at Cal Poly and Mississippi State more opportunities to collaborate, integrate, connect, and incorporate the key elements of a construction academic education.

Literature Review

A studio-based learning model has been used since the early twentieth century when architecture programs benchmarked their educational structures from the well-known Ecole des Beaux Arts in Paris (Lackney, 1999). They have remained the backbone of art-based programs' curricula. Many educators have furnished different definitions and specified certain characteristics of a studio space, however, the commonly accepted studio features include the working material (design project), a standard number of students (about 20), furniture and furnishings such as tables, papers, books, and models in a -typically- dedicated space in which students can spend the majority of their time (Schon, 1983). The use of a studio model has traditionally been limited to architecture programs but is emerging in other areas either individually or in collaboration with art-based programs (Carbone, Lynch, Arnott, & Jamieson, 2000; Jabi, Hall, Passerini, Borcea, & Jones, 2008). Developing the quintessential studio-based learning model has been the goal of many educators.

Many researchers have strived to portray a studio-based learning environment and characterize it. Brandt et al. (2011) illustrated the structure and order of a studio-based learning experience and believed the basic design of a studio is to simulate a professional work environment while maintaining the goal of learning and interacting with other students. Brandt et al. (2011) also provided the background information needed as to how a studio-based course was designed and implemented. The initial idea was originally to provide students with information, show a demonstration of how to apply the knowledge, and allow students to practice it. They concluded that the structure of a studio relies on the students' commitment to study and the ability to provide a simulated professional environment. The quality or level of learning was reliant on the way these two components combined. Cennamo and Brandt (2012) emphasized four aspects of the academic design studio: the physical space, the class structure, the pedagogy, and the theoretical framework.

Breaking down these four aspects of studio-based learning makes it is easier to understand and recognize the benefits. The space typically includes a central lecture area combined with individual student desks, available to them at all times, and display areas. It was often found that studio physical features naturally created a shift to more social and collaborative learning opportunities (Taylor, 2009). The class structure typically includes meeting for long periods of time for multiple times during the week. This tends to result in students prioritizing their studio classes over other classes thus successfully establishing a culture where projects took precedence (Cox et al. 2009). The pedagogy for a studio model is project-based learning and assignments followed by the presentation of student work for critique (Schon 1983). The propose-critique-iterate cycle or process of studio-based learning (SBL) as referred to by Brocato (2009) and results in "positioning of the work in a critique space that renders the work never complete, always on a pathway toward better iterations" (p.142). The theoretical framework includes social concepts such as community of practice (Shaffer's 2007), which highlights the interaction of student and instructor within a studio model. In this framework or space, instructors often act as "brokers" between academia and professional environments (Driscoll, 2005) and are responsible for creating a balance between an academic culture and professional practice.

Methodology

In the Fall of 2017, a previous study was conducted by the construction program at Mississippi State University, which focused on the students' studio experience at that program. The construction program at Mississippi State has been utilizing a studio-based classroom experience for several years and sought to assess the student's perception of their studio model. This previous survey was conducted to assess their students' perspectives of the studio-based aspects of the construction education program (Rokooei & Hall, 2018). The results of this survey and analysis can be found and are published in the 54th Associated Schools of Construction International Conference Proceedings.

Born from this previous endeavor, a similar study was conducted with the students in the Construction Management Program at the California Polytechnic State University regarding their students' perceptions and experiences of a studio-based model. It is intended to compare the results and obtain more robust conclusions. In the Spring Quarter of 2019, a survey was issued to predominately senior level students which resulted in quantitative research data being generated. By the time Cal Poly construction management students reach their senior year, most have experienced at least five studio-based courses in the program. The survey's questions were segmented into four broad categories:

- Demographics: student gender, year, and work experience.

- Studio effectiveness: including level of engagement, program fit, etc.
- Studio optimization: including the course aspects, hours, layout, etc.
- Studio learning: including the difficulty, structure, and overall rating.

The Cal Poly survey was distributed by paper to a group of 70 senior students in the construction in class, of which 65 complete responses were received. Data was compiled, modeled, and analyzed with statistical software.

Results

Of the 65 students who participated in the study and fully responded to the survey, 23% were female. The male student group reported having an average work experience of 9.52 months, whereas the female group had 11.4 months at the point this survey was taken. Participants were asked to rate the effectiveness of their studio-based core courses compared to traditional lecture-based classes based on a variety of potential outcomes using a 5-level Likert scale (1: Very Low, 5: Very High). Figure 1 shows the average score for each potential outcome.

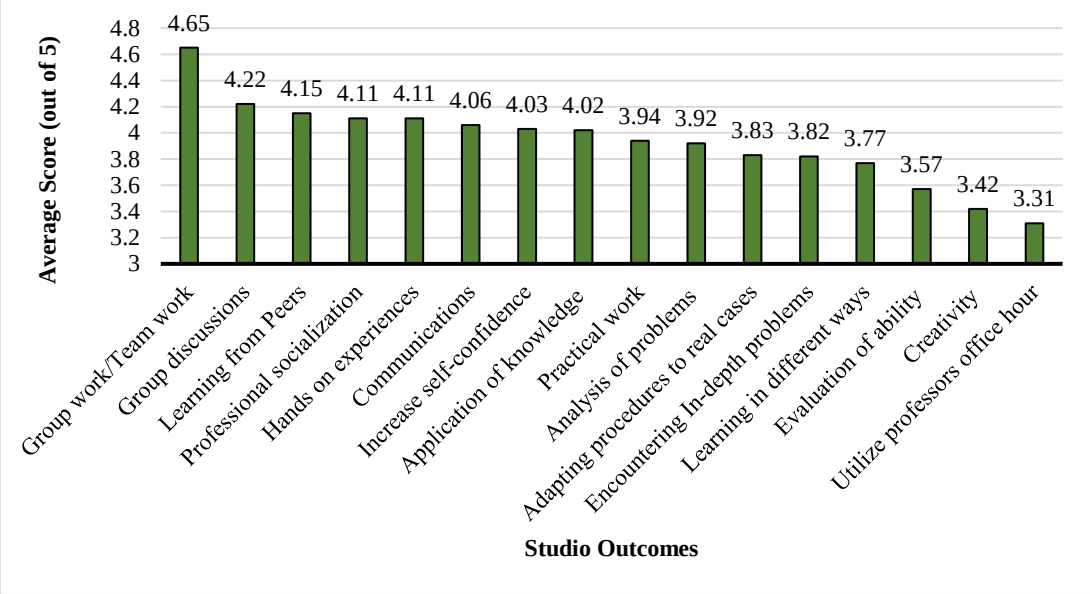

Figure 1: Average score of studio outcomes

The outcome results were reorganized based on which students believed the studio-based models to be most effective. Group work, group discussion, and learning from peers received the highest scores overall. Interestingly female and male student groups rated different items for their top choices. Except for "Group work/Team work" that was overwhelmingly rated by both groups as the highest-scored studio outcome, other high scores outcomes were different. The female student group rated "Professional Socialization" (4.2 out of 5) and "Learning from Peers" (4.2 out of 5) as the most effective outcomes of the studio-based learning whereas the male student group rated "Group Discussions" (4.3 out of 5) and "Hands-on Experiences" (4.16 out of 5) highest. Students were also asked to rate their level of engagement during the studio-based core course versus lecture course using

a 5-level Likert scale (1: Very engaged to 5: Not engaged). Figure 2 shows the percentages of each level of engagement of students during studio courses and lecture courses.

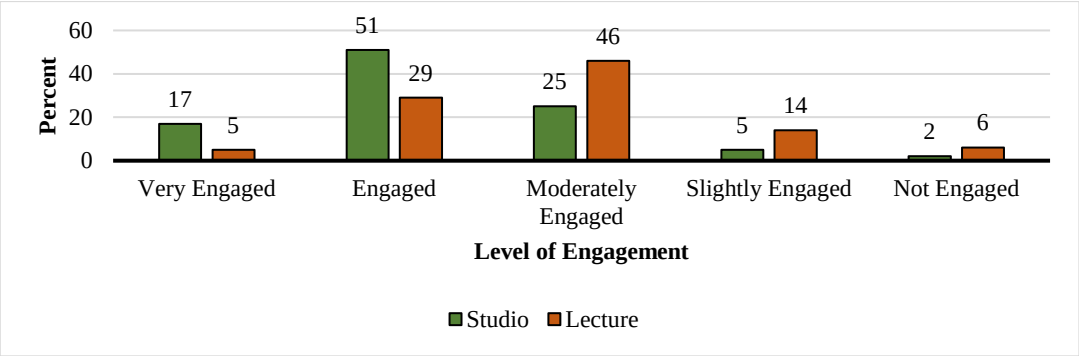

Figure 2: Percentages of levels of engagement during a studio course and lecture course

Students were asked to report the amount of study time they did outside the studio classroom in their typical core courses, the results are shown in Figure 3. Ninety percent of students reported spending less than 11 hours/week on assignments and homework outside of class time.

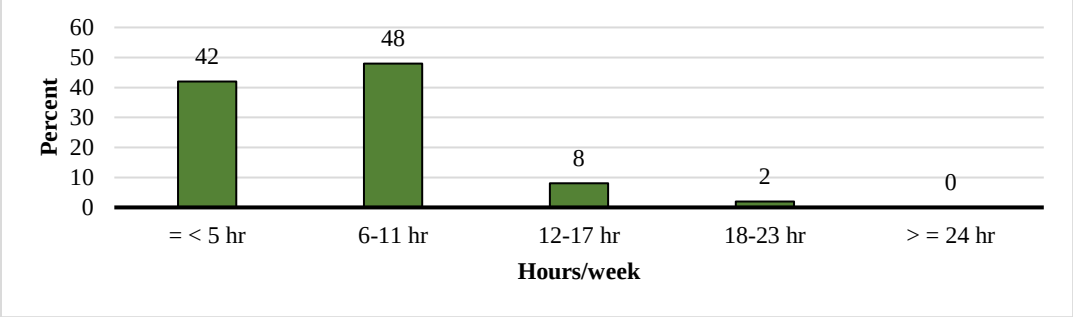

Figure 3: Reported time spent outside studio by student

Students were asked to rate to what extent they believe a studio-based curriculum is appropriate for a construction management program. As illustrated in the Figure 4, the majority of students (89%) believe a studio-based learning model is either appropriate or absolutely appropriate for the construction program.

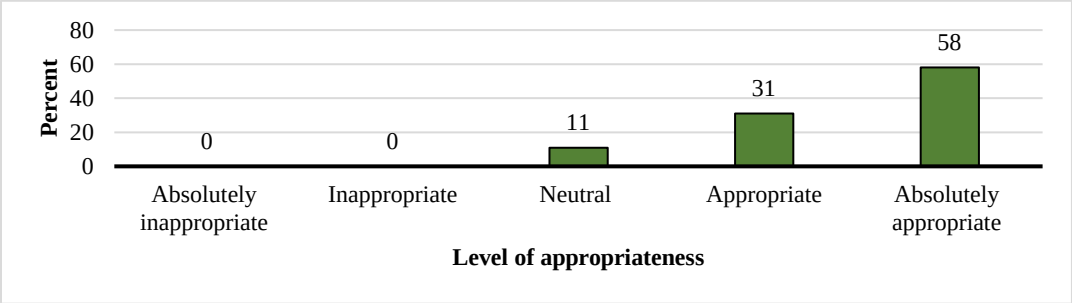

Figure 4: Reported level of appropriateness of studio for construction programs

Students were asked to select the preferred course structure in a studio-based environment. Based on the percentages of each option provided in Table 1, students overwhelmingly prefer to work on a number of short projects (either related or as part of a larger project) in their studios.

Table 1
Percentage of each possible studio structure

Alternative	Percentage
Alt 1: Working on one large project throughout the semester	8
Alt 2: Working on a few shorter projects and examples that are related to each other	45
Alt 3: Working on a few unrelated shorter projects	2
Alt 4: Working on a series of shorter projects that leads and informs a larger project	45
Total	*100*

Students were asked to identify the type of studio activity engagement (by percentage) that instructors and students had during in class studio time. The average of each option's percentages is listed in Table 2.

Table 2
The average percentage of each educational interaction in studio

Studio Activity	One on one discussions with students	Discussions and interactions with each group/team	Class presentations/ General discussions	Mentoring/ Coaching	*Total*
Percentage	19	26.92	30.77	23.31	*100*

Next students were asked to specify how many hours in a day is an optimum number for studio meeting time. The possible options included 2 hours, 3 hours, 4 hours, and 5 hours. The reported average percentages are shown in Figure 5. Students are currently in class 3-4 hours in any particular day.

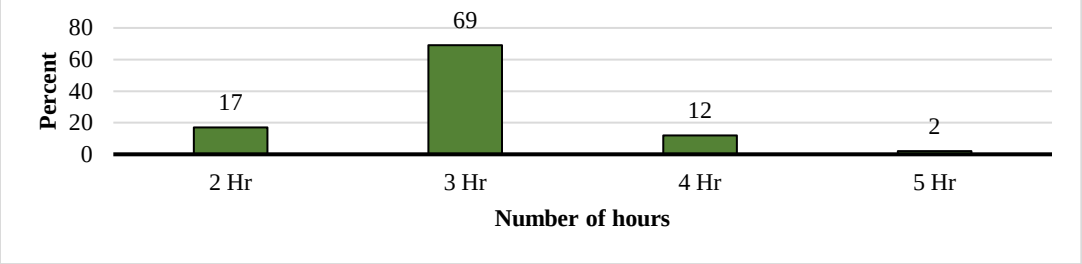

Figure 5: Percentage of each number of hours for studio sessions

Similarly, students expressed their opinion on the optimum number hours per week spent in each studio. Figure 6 shows the percentage of average scores for each number of hours option. Currently students are in studio labs 13 hours/week.

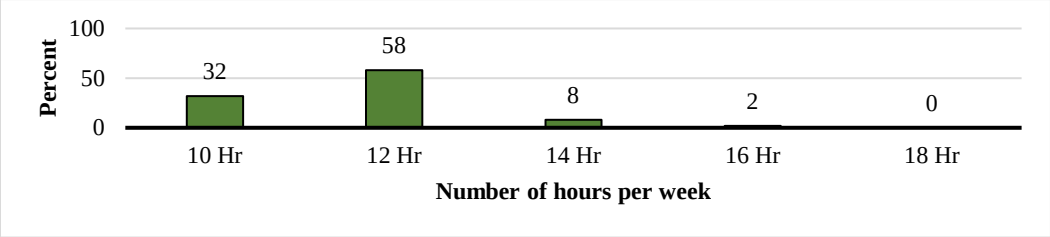

Figure 6: Percentage of each number of hours for studio per week

Finally, students rated the overall quality of their studio-based curriculum in Figure 7, which shows that 91% of students believe their studio-based construction program is either good or very good quality compared to typical construction programs.

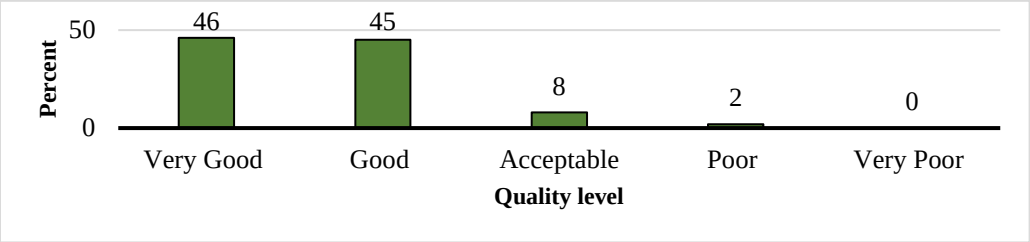

Figure 7: Percentage of program overall quality

Discussion

Based on this survey, it is clear that a studio-based learning model has many positive student outcomes that are valuable to the construction programs which implement them. Students in this study emphasized the importance of group interactions in studio environments such as group work, group discussion, learning from peers, and professional socialization. These outcomes cannot be harvested easily in other educational models such as lecture-based courses. Group interactions in studios provide the opportunity for a full-network engagement which results in better communication, active learning, and ultimately a higher quality education. Another positive aspect of the studio-based model is the student's level of engagement. Studio environments allow instructors to use a variety of educational tools and methods to achieve their learning outcomes and goals for the class. A relatively high number of contact hours (compared to the traditional courses) increases the interaction between students and instructors with one-to-one, group, and general discussion activities. This constant but varied involvement results in students being more engaged during class time and thus provides more learning opportunities. Spending a significant amount of time in studio, working on assignments and projects, decreases the amount of time required outside the class with 90% of students spending 11 hours or less. These purported hours are about what would be expected for a course that has a configuration of two activity hours and three lab hours. Students also asserted that 3 hours per day, four days a week is optimal for a studio-based model. These 3-hour blocks of time in one day gives an instructor the opportunity to introduce a subject, provide a short lecture, assign a related project, and conduct an activity that follows and connects the material being studied.

From the data we identified where female and male students differed significantly in their responses. Female students had on average more internship experience by almost two full months. Female

student's ranked "professional socialization" and "learning from peers" as their highest studio outcomes. Male students ranked "group discussion" and hands-on experiences" highest. Female students overwhelmingly reported both a higher level of satisfaction and a higher level of difficulty in their studio courses as compared to male counterparts. These differences are difficult to explain, but many faculty in the program have observed that our female students take on a leadership role in many of our core construction management courses. This may contribute to our female student perceptions that our core studio-based courses are more difficult and more satisfying than our male students.

A strong majority (eighty-nine percent) of students believe a studio-based educational model is very appropriate and positive for this construction management program. The high ratio of students preferring this type of instruction means they have bought-into the studio-based model concept, which only increases the likelihood of a successful outcome and student experience. The overall results of the survey should be very affirming to this construction program. A significant amount of private funding was secured to achieve this physical studio-model space, which was built 15 years ago. Seeing the overwhelmingly positive student perspectives on how the department applies and uses these studio-based facilities is heartening.

Over the years, this department has made a number of adjustments to the program that also seemed to have worked out well based on the students' responses. Several years ago, the department reduced the core class structure from 6 units (all laboratory) to 5 units (3 lab and 2 activity). This in turn reduced the total contact hours per day and per week to an amount that matches very closely with students' purported ideal. A second example is some of the professors in the department transitioned from one large project due at the end of the course to requiring the students to make incremental progress throughout the quarter on their projects. Having one large project due at the end of the quarter was problematic for some students as they would tend to procrastinate and scramble to complete their projects. This pedagogical change is also in line with the students' perceptions shown in the survey.

Conclusion

Student perceptions are clearly useful in helping educators design, develop, and implement a studio-based model education in construction programs. This study highlights two such processes: First, the physical aspect which includes the proper number of students in studio, physical layout of studio, chair and table comfort, number of hours per day and total hours per week. Second, the content aspect of studio which includes the type of activities, faculty interaction, areas of development, and engaging approaches. Considering both of these dimensions in conjunction with one another will help educators model an effective studio-based learning structure. In the future we should continue to consider our students' perceptions when planning to make further adjustments to an already successful application of the studio-based education model within a construction management program.

Generalization of results is not currently proper due to the sample size. This survey is only a small example of the work and research which needs to be done in the area of studio-based educational models, project-based learning, and inter-professional education as it relates to university programs which are grounded in professional practice. It is recognized how difficult it is for educators in professional programs to justify and convince administrators of the positive outcomes and the high quality of education that results from these pedagogies. They are certainly resource intensive in respect time, energy, and money. That is why it is crucial that we continue to document and assert this three-pronged educational approach to professional degrees. It is not only positive for the students in these studio-based classes but essential in preparing future young professionals to enter the workforce fully prepared to succeed.

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