Communicative Learning in an Interdisciplinary Design Studio

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Complex design problems rely on communicative skills that build empathy through understanding, rather than reify disciplinary tensions. While these 'soft skills' are critical, they are not yet a fundamental part of design education. Design studio courses in undergraduate education tend to craft simplified simulations of professional practice experiences to explore formal, organizational, conceptual, and technical design approaches. One common simplification is for each discipline to learn independently in isolated courses, without being informed by the realities of multi-disciplinary practice. 'Communication' in these siloed studios refers to graphic and verbal presentations that convey student ideas to peers, faculty, and perhaps practitioners, with an emphasis on disciplinary conventions and graphic skills, and the use of discipline-specific language. Yet successful communication in practice requires complex and inclusive skills beyond the products of design, and leverages both interpersonal and intrapersonal communication skills in order to advocate for disciplinary values and needs during design negotiations.

This paper describes the course format and outcomes for an interdisciplinary design studio consisting of students and faculty from architecture, landscape architecture, and structural engineering. The studio took a communicative learning approach to the development of communication skills such as empathy, resilience, flexibility, and competence-based trust as integrated factors of design. Students were assigned to 7-person teams to design a campus media library and landscape. Lectures, activities, and readings scaffolded the learning of both soft skills and technical design skills in the studio. In grading the student projects, equal weight was given to evidence of the development of communicative skills and to the attainment of design goals. Outcomes were measured using several instruments, including surveys, writing assignments, and presentation prompts that focused on describing interactions between the disciplines rather than solely on design product.

INTRODUCTION

While the value of interdisciplinarity in the design of the built environment is clearly understood, methodologies for teaching interdisciplinary practice to undergraduate Architecture students are underdeveloped. This paper describes *communicative learning* as a framework for an interdisciplinary design studio for undergraduate Architecture, Landscape Architecture, and Architectural Engineering[1] students.

Complex design problems rely on communicative skills that build empathy through understanding, rather than reify disciplinary tensions. While these 'soft skills' are critical, they are not yet a fundamental part of design education. This paper posits that by teaching soft skills to students in an interdisciplinary design studio, their capability to work effectively as a team to produce a responsive and coordinated design proposal increases. Design studio courses in undergraduate education tend to craft simplified simulations of professional practice experiences to explore formal, organizational, conceptual, and technical design approaches. One common simplification is for each discipline to learn independently in isolated courses, without being informed by the realities of interdisciplinary practice. 'Communication' in these siloed studios refers to graphic and verbal presentations that convey student ideas to peers, faculty, and perhaps practitioners, with an emphasis on disciplinary conventions and graphic skills, and the use of discipline-specific language. Yet successful communication in practice requires complex and inclusive skills beyond the products of design, and leverages both interpersonal (between) and intrapersonal (within) communication skills in order to advocate for disciplinary values and needs during design negotiations. (Fig. 1)

INTERDISCIPLINARITY, LANGUAGE, AND COMMUNICATIVE LEARNING

Given that this paper is about effective communication, it is important to define a few terms. Julie Thompson Klein, a scholar writing on the topic of interdisciplinary communication and collaboration, states: "*Interdisciplinarity* integrates information, data, methods, tools, concepts, or theories from two or more disciplines or bodies of knowledge to address a complex question, problem, topic, or theme. Work may occur individually or in teams, though in the latter case, communication is essential to successful collaboration."[2] While interdisciplinary work can, and often does, occur through cycles of independent work and then coordination, *integrated design* (or integrative design) goes a step further. According to the Green Building Alliance, "In the past, team members would work independently on their part of the project, resulting in an overall lack of coordination and communication, leading to many problems within the process and inefficiencies within the building's systems. Integrative design, however, promotes the collaboration of all

Figure 1. Integrated design team charette. Ellen Burke.

of these groups. By working together, the team as a whole will have a better understanding of the project and will start their work together in the predesign phases and then continue to collaborate throughout the occupancy stage."[3] The interdisciplinary design studio discussed in this paper is presented (to students and readers) as an integrated design studio due to the level of expected collaboration.

While technical ('hard') skills are critical for successful integrated design practice (and tend to be the focus of design studios), soft skills like effective communication across disciplines are foundational, and thus underly all of the assignments and activities in the studio. The emphasis on soft skills is based on the theory of *communicative learning*, a theory of adult education pioneered by Jack Mezirow. One of the goals of communicative (also called transformative) learning is to become empathetic of others, and to become critically reflective of what is read, seen, or heard. Empathy (and similar traits like listening and respect) have been identified by industry leaders as key skills for design in architecture and the allied fields of landscape architecture and engineering, as well as in the sciences where discovery relies on well-functioning teams. According to Mezirow, "Communicative learning involves at least two persons striving to reach an understanding of the meaning of an interpretation or the justification for a belief. Communicative learning involves understanding purposes, values, beliefs, and feelings ... it becomes essential for learners to become critically reflective of [underlying] assumptions."[4] Mezirow describes communicative learning as allowing students to "work with others to arrive at tentative best judgment regarding contested beliefs."[5] In the context of an integrated design project, student teams will not succeed without this capacity.

While architectural education tends to overlook the importance of these soft skills, in practice, complex design problems call for communicative skills that rely on empathy. Articles in professional journals call for graduates to be "people savvy," with empathy and communication skills (AIA)[6]; to have communication skills, flexibility, adaptability, curiosity, and listening skills (American Society of Landscape Architects)[7] ; and to "motivate, inspire, and respect team" with communication,

listening skills, and empathy (*Leadership and Management in Engineering Journal*)[8].

Philosopher and critical theorist Jürgen Habermas and interdisciplinary scholar Julie Thompson Klein have proposed a thesis on interdisciplinary communication. Their thesis claims: "that integrating two or more disciplinary languages can generate a new common understanding through reciprocal comprehension and consensus...consensus is a social–psychological construct requiring individual commitments to bring about intersubjective mutuality. The keys are common vocabulary, shared knowledge, reciprocal comprehension, mutual trust, and social accord."[9] Klein states that: "language shapes the ways speakers conceptualize their worldviews, including the ways they think (cognition) and act (behavior)."[10] She describes an urban development project in which the interdisciplinary team found that, despite their shared interest in and knowledge of urban development, discipline-specific language was a barrier to effective communication as a team. "One group (morphologists) was rooted in the academic culture of architecture and urban planning, while the other group (physiologists) was composed of natural scientists, engineers, and an economist. Participants found that even such basic words as *landscape, urban, project,* and *process* were understood differently... Successful collaboration, they added, requires getting past nonspecialist understandings of common colloquialisms and trying out terms that foster 'interdisciplinary connectivity' through bridge words."[11] This issue of assumption of meaning and understanding arose in the context of our studio, and will be described in more detail in the Methodology section.

The following sections describe the course Format, Methodology, Verbal and Graphic Communication activities, and Outcomes for an integrated design studio based on communicative learning, consisting of students and faculty from Architecture, Landscape Architecture, and Architectural Engineering.

INTEGRATED DESIGN STUDIO: FORMAT
The integrated design studio combined traditional problem-based learning (to foster hard skills) with activities and
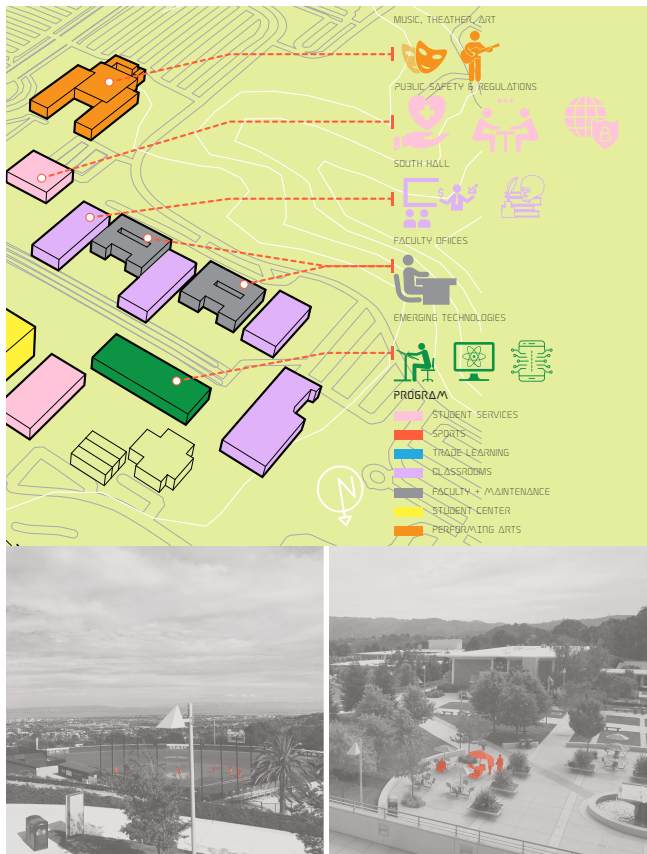
Figure 2. Excerpt from team site analysis showing campus program and use. Hyeonjong Kim, graphics.

lectures that developed soft skills essential for working across disciplines and in collaborative teams.[12] This studio consisted of 46 students from three majors: Architecture (17), Landscape Architecture (16), and Architectural Engineering (13). The studio was established and conducted by three faculty members, one from each major. Emphasizing the integrated design aspect of the course (in which all disciplines are involved from the beginning of the project), students were organized in teams of 6 to 8 with at least two members from each major. This studio took place in a 10-week quarter. Within this timeframe, teams worked collaboratively to design a campus media library and landscape for the College of San Mateo, a local community college located on a hilltop overlooking San Francisco Bay. All studio participants were fourth-year students, allowing them to practice the disciplinary skills gained over the previous three years of coursework. Pre-design activities in the studio included a precedent study of public libraries of varying scales and a site analysis of the campus and region. (Fig. 2) The design project was launched with a week-long team charette, in which the team members negotiated the siting and massing of the building. The charette was followed by an intensive five-week design period in which the teams developed a synthesized proposal.

METHODOLOGY

The studio took a communicative learning approach to the development of soft skills such as empathy and flexibility[13] as integrated factors of design. Lectures, activities, and readings scaffolded the learning of both soft skills and technical design skills in the studio. The primary course learning objectives, emphasizing collaboration and communication, were to:

1. Create an integrated building design that includes a sound project approach (scope, quality, and constructability) including land-use, site development, architectural vision, space planning, and the integration / synthesis of building and landscape systems.

2. Function effectively on an interdisciplinary team by communicating effectively utilizing verbal, written, and graphical methods, and integrate standards of professional and ethical responsibility into the working classroom relationships and the development of the integrated design.

Working within the complexities of differing needs and desires on an integrated design team is challenging. The integrated design process can be hampered by lack of literacy in the allied fields' disciplinary knowledge and underdeveloped communication skills. Professional designers who have worked on collaborative interdisciplinary teams for complex urban projects will recognize these experiences. For design students, these issues are magnified through lack of experience. The course learning objectives build on some of the principles of Mezirow's communicative learning to mitigate these challenges. Students must build an awareness of frames of reference (the body of experience that shapes cognition, belief, and perception) to be more effective and empathetic in working with others. Critical reflection and discourse with classmates are the tools to ultimately shift their thinking to more open and inclusive frames of reference.

In order to scaffold collaboration and communication in the studio, the faculty introduced lectures, individual and group

"Learning from team members with different mindsets and how to express my point of view in a way they'd understand."

While students identified soft skills as something they developed, they also ranked soft skills / team dynamics highest activities, and team assignments to integrate soft and hard skills. Lectures included 'Decision-making' and 'Soft Skills for Collaboration: Leadership & Listening.' Teams were asked to write a team contract, team values to guide their project, and a pull-schedule, and team members periodically conducted self-evaluations. These assignments in particular were meant to foster the development of empathy, which occurs through discourse - that is, being compelled to talk about their ideas with other students and come to agreement. While these items would not be found in a typical design studio, they were critical
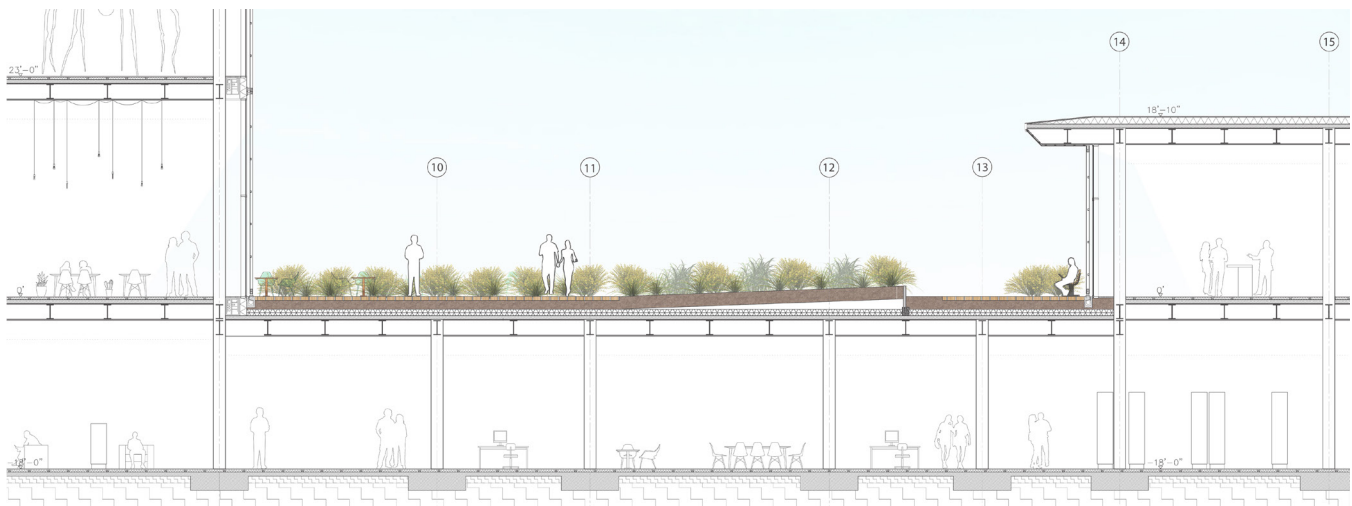
Figure 3. Collaborative team section drawing showing integration of spatial, structural, and landscape design strategies. Architecture: Maike Neubauer, Salman Al-Sulaiti; Landscape Architecture: Alex Michel, Nathan Kwong, Morgan Tashjian; Architectural Engineering: Lucy Donaldson, Daniel Li.

to healthy team functioning. They served as an underlay to the analysis and design sequence of the team project. The required project plans and sections were expected to be developed collaboratively and coordinated as Architecture, Landscape Architecture, and Architectural Engineering developed the design from each perspective.

While a variety of learning opportunities related to soft skills were interspersed throughout the quarter, we'll focus on two: an interdisciplinary communication activity and a team design development assignment.

VERBAL AND GRAPHIC COMMUNICATION

As an opportunity to highlight student (and faculty) assumptions about how we communicate verbally within and across disciplines, the faculty conducted an in-class activity called 'Communication: Vocabulary and Concepts' in which all students were asked to read a short article from each of three disciplinary magazines: *Architectural Design, Landscape Architecture*, and *Modern Steel Construction*. First, they were asked to identify three terms or phrases from each reading that were unfamiliar (or unfamiliar in their use), including for their own discipline, and to write definitions based on their understanding of each term or phrase in the reading. Then students and faculty had a discussion in small interdisciplinary groups in which students raised questions about terms, and other students responded and debated definitions. Terms such as *space frame* and *typology* (Architecture reading), *riparian* and *cribwall* (Landscape Architecture reading), and *box culverts* and *walking columns* (Architectural Engineering reading) were unclear or unfamiliar to many students.

Next, students were asked to identify how the concept of *flow* was embedded in all three readings, and how each discipline used the term differently. The Architecture reading used it as a description of a building's sinuous form, while the Landscape Architecture and Architectural Engineering readings were

both referencing stormwater management. Like the urban design project described by Klein, inevitably situations arose in the course of team discussions where terms or phrases had to be defined or clarified. But this discrete activity offered the chance to foreground this aspect of communication with faculty guidance.

As a means to further challenge teams in their communication and collaboration, the studio asked teams to work in greater detail on an on-structure landscape (a term more commonly used in Landscape Architecture, Architects often refer to this an an occupiable roof) which required the input of all three disciplines. The faculty conducted a workshop in which each discipline negotiated for their requirements for the on-structure landscape using a 1/4"=1'-0" section. This allowed students to see the impact of each discipline on the others, and to engage in compromises that supported the overall vision of the project. The final drawing for this section was create collaboratively, with no one major taking authorship. One student reflected: "When figuring out the 1/4" section, we realized that we underestimated the thickness of the ceiling structure so we ended up with only a 6' floor to ceiling height. We had to redesign a lot to fix it and this was due to the architects and architectural engineers not communicating fully to understand how deep it needed to be." Despite many reminders to students to coordinate issues like structural depth and ceiling height, it took this in-class workshop to draw attention to conflicts that existed in many projects. (Fig. 3)

OUTCOMES

In grading the student projects, equal weight was given to evidence of the development of communicative skills and to the attainment of design goals. Outcomes were measured using several instruments, including self-evaluations, writing assignments, and presentation prompts that focused on describing interactions between the disciplines rather than
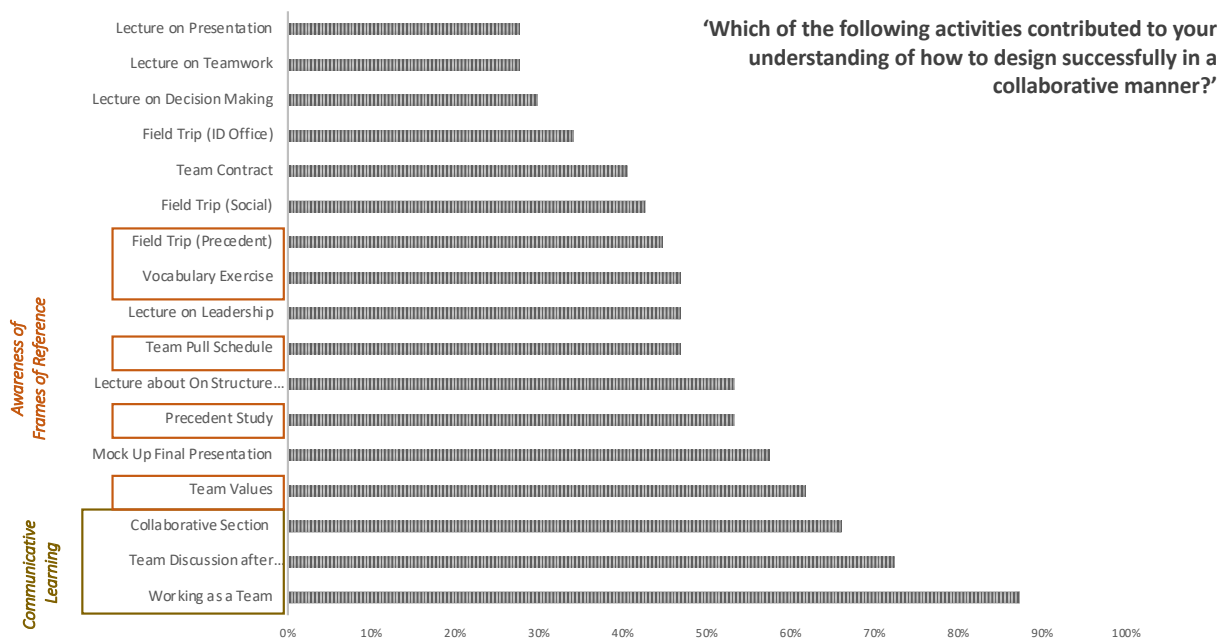
RESULTS I CRITICAL EXPERIENCES

Figure 4. Critical experiences in the studio, as identified in a student survey. Ellen Burke.

solely on design product. In examining the design drawings, it is difficult to parse out the role of communication, other than to see the disciplines' needs given equal weight to produce a coordinated design. Instead, the surveys and self-evaluations are more effective tools for evaluating the role of soft skills in the design process. Students completed self-evaluations at midterm and final. Surveys to assess communicative and collaborative learning at the end of the quarter asked students:

• Which of the following activities contributed to your understanding of how to design successfully in a collaborative manner?

• What new skills or concepts did you learn during this project?

• Describe a moment or event when you felt extremely challenged or frustrated with the design process.

• If you could start over now with the same team and same project, what would you do differently to get a better result?

The results of these surveys were analyzed using a qualitative thematic method. For beneficial activities, students ranked highest those that fall under communicative learning, including the collaborative section, team discussion after midterm, and working as a team. Activities that fostered an awareness of frames of reference also ranked highly, including team values and pull schedule, precedent study, vocabulary activity, and field trip. For skills learned in the studio, interpersonal soft skills

were ranked highest, with hard skills and management/coordination skills second and third. (Fig. 4)

Student comments in response to the question about new skills and concepts included:

"This was my first time working with other disciplines, which really helped me expand my views and thought process as a designer."

"Different disciplines working together and considering each other's point of view. A concept can be applied differently depending on the discipline."

"Learning from team members with different mindsets and how to express my point of view in a way they'd understand."

While students identified soft skills as something they developed, they also ranked soft skills / team dynamics highest when asked about the greatest challenges in studio. Students identified communication as the number one way to improve their performance and experience in the studio if they were to do it again.

In conclusion, this integrated design studio shows that soft skills can (and should) be taught in design studio. As seasoned professionals we often take communication skills for granted, and assume that the design studio (project-based learning) is already a communicative learning format. But it was revelatory to the students in this studio how much communication was a critical part of the design process. Takeaways for future iterations of
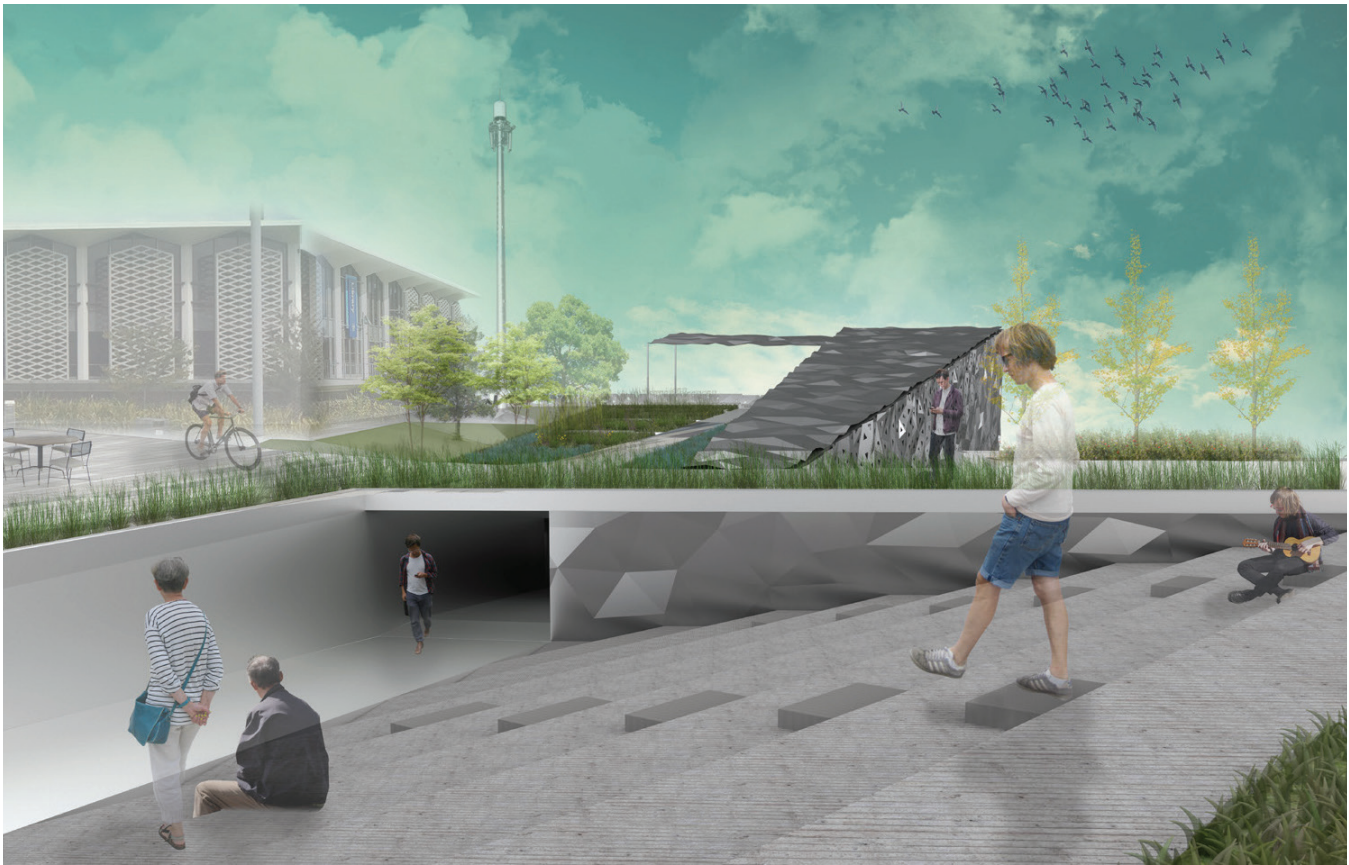
Figure 5.Rendering of final design proposal showing architecture, landscape architecture, and structure working in concert. Architecture: Wood Cheng, Brad Foster; Landscape Architecture: Breanne Alton, Michele Iseli, Arthur Takioto; Architectural Engineering: Nate Moore.

this studio include the importance of scaffolding opportunities for awareness of frames of reference, and emphasizing communication skills, leadership, and team collaboration to foster self-reflection and adjustment of collaborative skill sets. (Fig. 5)

ENDNOTES

1.   While the major is called 'Architectural Engineering,' it is a Structural Engineering program. Cal Poly describes the distinction in this way: "As an architectural engineering program the curriculum goes beyond the traditional structural engineering program to give students an interdisciplinary understanding of architecture and construction management as it relates to total project design and implementation." (https://arce.calpoly.edu/content/programs/undergraduate)

2.   Julie Thompson Klein, "Communication and Collaboration in Interdisciplinary Research," in *Enhancing Communication & Collaboration in Interdisciplinary Research*, ed. Michael O'Rourke (Thousand Oaks: SAGE Publications, Inc., 2016), 13.

3.   "Integrated Design," Green Building Alliance, accessed October 1, 2019, https://www.go-gba.org/resources/green-building-methods/integrated-design/.

4.   Jack Mezirow, "Transformative Learning: Theory to Practice," *New Directions for Adult and Continuing Education*, no. 74 (1997): 6.

5.   Mezirow, "Transformative Learning: Theory to Practice," 6.

6.   Alice Liao, "The 21st Century Skills Set for Architects," *Architect Magazine: The Journal of the AIA*. June 2, 2015, accessed October 1, 2019, https://www.architectmagazine.com/practice/the-21st-century-skill-set-for-architects_o.

7.   "Skills for Success in Landscape Architecture," *The Field: ASLA Professional Practice Network Blog*, June 21, 2016, accessed October 1, 2019, https://thefield.asla.org/2016/06/21/skills-for-success-in-landscape-architecture/.

8.   Sanjeev Kumar, and J. Kent Hsiao, "Engineers Learn 'Soft Skills the Hard Way': Planting a Seed of Leadership in Engineering Classes," *Leadership and Management in Engineering 7*, no. 1 (2007): 20.

9.   Klein, "Communication and Collaboration in Interdisciplinary Research," 14.

10.   Klein, "Communication and Collaboration in Interdisciplinary Research," 14.

11.   Klein, "Communication and Collaboration in Interdisciplinary Research," 15.

12.   The studio was sponsored by a grant from the LPA Foundation to increase interdisciplinary learning opportunities in our college.

13.   Anaïs Gibert, Wade C Tozer, and Mark Westoby, "Teamwork, Soft Skills, and Research Training," *Trends in Ecology & Evolution 32*, no. 2 (2017): 81.