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Mass Timber Interdisciplinary Studio

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The Mass Timber Interdisciplinary Studio at Cal Poly's College of Architectural and Environmental Design originated as an innovative approach to bridge the gap between traditional disciplinary silos and the collaborative demands of modern architecture, engineering, and construction (AEC) practice. The studio evolved from the Integrated Project, Design, and Program Management course in Construction Management and was restructured to serve as a college-wide interdisciplinary experience that included Construction Management, Architecture, Landscape Architecture, and Architectural Engineering faculty and students. Together, these disciplines and their roles in the Mass Timber Interdisciplinary Studio simulated professional collaboration and negotiation in a project-based learning environment. This paper discusses the stakeholders, course design, and project-based learning strategies undertaken in the course, offering lessons for AEC professional and academic parties who may be interested in educational partnerships. Through a shared design project, field work, lectures by mass timber construction industry partners, and collaboration skill-building, the Mass Timber Interdisciplinary Studio provided students with an opportunity to learn together about a material that is both traditional and cutting-edge, a regional resource with global implications, and an exemplar of the interdisciplinary knowledge needed to pursue ambitious climate action goals.

Key Words: Mass Timber, Interdisciplinary Design Collaboration

Studio Introduction and Stakeholders

The Mass Timber Interdisciplinary Studio at Cal Poly's College of Architectural and Environmental Design originated as an innovative approach to bridge the gap between traditional disciplinary silos and the collaborative demands of modern architecture, engineering, and construction (AEC) practice. The Mass Timber Interdisciplinary Studio (hereafter referred to as "the Studio") evolved from the Integrated Project, Design, and Program Management course in Construction Management and was restructured to serve as a college-wide interdisciplinary experience.

The Studio was conceived to address well-documented challenges in AEC education: students often graduate with strong technical skills but limited experience in interdisciplinary teamwork, integrated design processes, and sustainable delivery methods such as mass timber construction. The faculty designed the Studio as both a pedagogical experiment and an applied research platform inspired by industry innovations. The first offering brought together four classes from four departments, taught by the authors and two other faculty from Construction Management, Architecture, Architectural Engineering, and Landscape Architecture. Its objective was to replicate the integrated workflow of real projects—where architects, engineers, and builders must coordinate from concept to construction.

The inaugural Studio brought together ninety-nine third- and fourth-year students from four disciplines – Landscape Architecture, Architecture, Architectural Engineering, and Construction Management – to.simulate professional collaboration and negotiation in a project-based learning environment.

Corporate and Industry Collaborators

The Studio was designed in collaboration with leading firms across the mass timber and construction sectors. Industry mentors participated in reviews, workshops, and field visits, representing expertise in forestry, manufacturing, architectural design, structural engineering, construction management, life-cycle assessment, and fire safety. Collaborators represented all four disciplines and included XL Construction, Kalesnikoff, Rothoblass, Simpson Strong Tie, SERA Architects, DCI Engineers, Timberlab, ZGF, and Sasaki, among others. These partners provided technical lectures, design critiques, and project case studies that expose students to real-world project constraints and innovations. Weekly integrated sessions—combining faculty guidance, industry mentorship, and student collaboration—made the studio a living laboratory for hands-on, Learn-by-Doing education, aligning Cal Poly's pedagogical mission with national leadership in mass timber and sustainable construction research

Course Design and Learning Outcomes

To design the course, the five instructors began by establishing three pedagogical lenses to convey to students how mass timber construction fosters interdisciplinary collaboration: **environment**, **experience**, and **economy**. These three lenses guided the development of learning objectives and cornerstone aspects of the class that were shared across disciplines, including a lecture series, field trips, case studies, and a full-scale mass timber mock-up. Students shared a project site and architectural program in Portland, Oregon, which facilitated project- and place-based learning and the ability for students to apply lessons from industry partners located within this region. The instructors worked together, with mixed success, to anticipate and address key interdisciplinary challenges, including communication and collaboration skills, for the duration of the Studio.

Three Pedagogical Lenses: Environment, Experience, and Economy

One initial challenge in integrating four courses across four disciplines was that each course had distinct learning objectives in service of its disciplinary curriculum, which reinforced the specialized language and values of that discipline:

- Landscape Architecture's Natural Environments Studio – site analysis and design, regional and local community, ecosystem, and material research, and carbon evaluation
- Architecture's Integrated Design Studio – conceptual design, architectural design, building performance, and sustainability integration
- Architectural Engineering's Capstone Project – structural design and material optimization
- Construction Management's Integrated Project Delivery – constructability analysis, project feasibility, project delivery, cost estimating, scheduling, site logistics, construction proposal package

While these course objectives have clear connections to each other, they also illustrate inherent differences between the disciplines, including the scale of the project (a single building vs. a larger forest and park system), and each discipline's timeline for work (architects and landscape architects wanted to explore design options for several weeks, architectural engineers and construction managers wanted a well-developed design early on). Even within the shared topic of mass timber, faculty and students from each discipline entered the collaboration with a narrowly-focused interest, ranging from forest management to aesthetics to performance to construction sequencing. To address this, it was necessary to develop shared language, shared values, and a shared vision for the Studio that would facilitate productive collaboration and mirror the integrated project delivery necessary to build with mass timber in practice. Faculty discussions frequently returned to the question: *why mass timber?* Why build with mass timber, and why teach it in an interdisciplinary setting? It was equally productive to ask: *why (or when) NOT mass timber?* These discussions led to the development of three pedagogical lenses of mass timber for the Studio: Environment, Experience, and Economy.

Environment: Mass timber is generally considered a more sustainable alternative to steel and concrete structural systems; it has less embodied carbon because it requires less energy to produce, and it stores carbon for the lifetime of the material (which may include disassembly and re-use of structural components). Wood is a renewable resource, however, forests must be properly managed to facilitate sustainable growth and harvesting of timber while also supporting the biodiversity of the forest ecosystem. Timber must be harvested and manufactured as locally as possible to the construction site to minimize carbon emissions resulting from transportation. These issues were highlighted in a guest lecture to the Studio by TimberLab on the transparent material sourcing for the Portland International Airport (PDX), which involved a regional network of 40 landowners, mills, and fabricators, including family-owned and tribally-owned forests, to supply 2.2 million board feet of timber. A guest lecture by Sasaki detailed their efforts to evaluate embodied carbon at the scale of building and landscape using their Carbon Conscience tool.

Experience: A mass timber building looks, feels, smells, and sounds different than a steel or concrete building; it is a multi-sensory experience that can only be fully appreciated in-person. This is due not only to wood's material properties, but also the fact that it can remain exposed without layers of fire protection or finishes. This multi-sensory experience can positively impact human health and wellness through reducing toxic off-gassing of structural and finish materials, and through encouraging biophilia: a psychological and physiological connection to nature in the built environment. This was immediately evident in the Studio's field visit to a mass timber construction site on a Silicon Valley tech campus; while construction sites are typically unpleasant places, students commented on the visual warmth of the space, how nice it smelled, and how much they wanted to touch the wood structure.

Economy: Current mass timber construction practices are perceived as more expensive than concrete or steel. While the increasing adoption of mass timber may narrow this gap, it underscores the importance of optimizing material efficiency through the design and engineering of structural bays and members. Mass timber also has inherent cost advantages, namely in time savings through standardization and prefabrication and construction sequencing. In addition to using construction budget as a metric of success, the Studio sought to make a value proposition for mass timber by considering other metrics such as human health and wellness, employee recruitment, retention, and productivity, higher rents and re-sale value, and the marketability and brand value of mass timber buildings. These other metrics were cited by industry partners as key considerations in offsetting mass timber's higher construction cost.

Students were introduced to these three pedagogical lenses of mass timber through an introductory case study assignment, in which interdisciplinary teams studied an exemplary mass timber building, and the land, people, and processes which contributed to it. The content of these case studies was organized to encourage students to communicate across disciplines in order to draw more holistic conclusions about the projects in terms of Environment, Experience, and Economy. These discussions laid a foundation for future collaboration across disciplines.

Designing with Mass Timber: Project-Based Learning and Site Selection

Portland, Oregon was selected as the Studio site of focus. Located at the heart of diverse ecosystems, an urban hub in a complex landscape of forests and forestry, Portland as site, city, and region enabled students from all four disciplines to apply the three lenses of Environment, Economy, and Experience. This regional context inspired the project site and program and enabled the Studio to connect with ZGF Architects and TimberLab, who led the design, material sourcing, and construction of the recently completed mass timber Portland International Airport. These connections helped students understand the specific local and regional implications of mass timber as a material system and identify its opportunities and challenges. With this understanding, students were able to propose thoughtful design strategies to support forest regeneration, help decarbonize the built environment, and encourage reciprocity between urban and rural communities and ecosystems.

Mass Timber Building Project Site and Program: PDX Food Hub. Led by Architecture students, students from all four disciplines collaborated on a speculative building project, the PDX Food Hub. Located within a real-world ongoing urban design project in Portland's Pearl District, the project site is currently a parking lot situated between the North Park Blocks (a historic but underutilized city park) and a future planned park, the NPBx. The Food Hub was conceived as a public building and landscape that could be a permeable threshold between these park spaces. Students' proposals were required to incorporate processes of food production, distribution, preparation, and consumption—understood through programmatic typologies of the Farm, the Market, the Kitchen, and the Table. The Food Hub project's programmatic objectives were to cultivate public interest in Portland's local food and its production; bring diverse people together in an active public space using food as a catalyst; support and promote public health and ecological health; and engage the neighborhood, the city, the region, and their histories.

The project brief, titled "Food/Wood/Good," asked students to consider the parallels and intersections of farm-to-table, and forest-to-frame. Like food, mass timber is both a natural product and an engineered one, ideally grown locally and sustainably and minimally processed, and a feast for the senses that is both pleasurable and ethical. In that context, students were required to showcase mass timber as a structural material, including at least one long span space, with objectives to support and promote the local forests, industries, and people who produce wood; demonstrate Portland's commitment to healthy people and a healthy planet; and create a memorable experience for locals and visitors that is uniquely Portland. Students collaborated on site design, program development, structural design and systems integration, project management, and construction costs and sequencing issues (Figure 1).

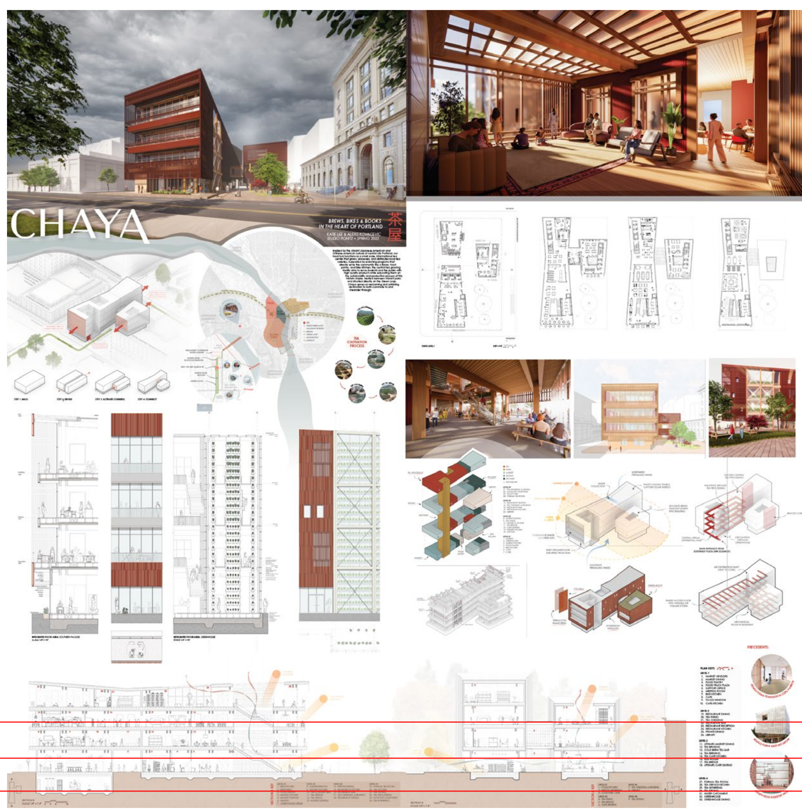

Figure 1: Example of PDX Food Hub Final Interdisciplinary Design

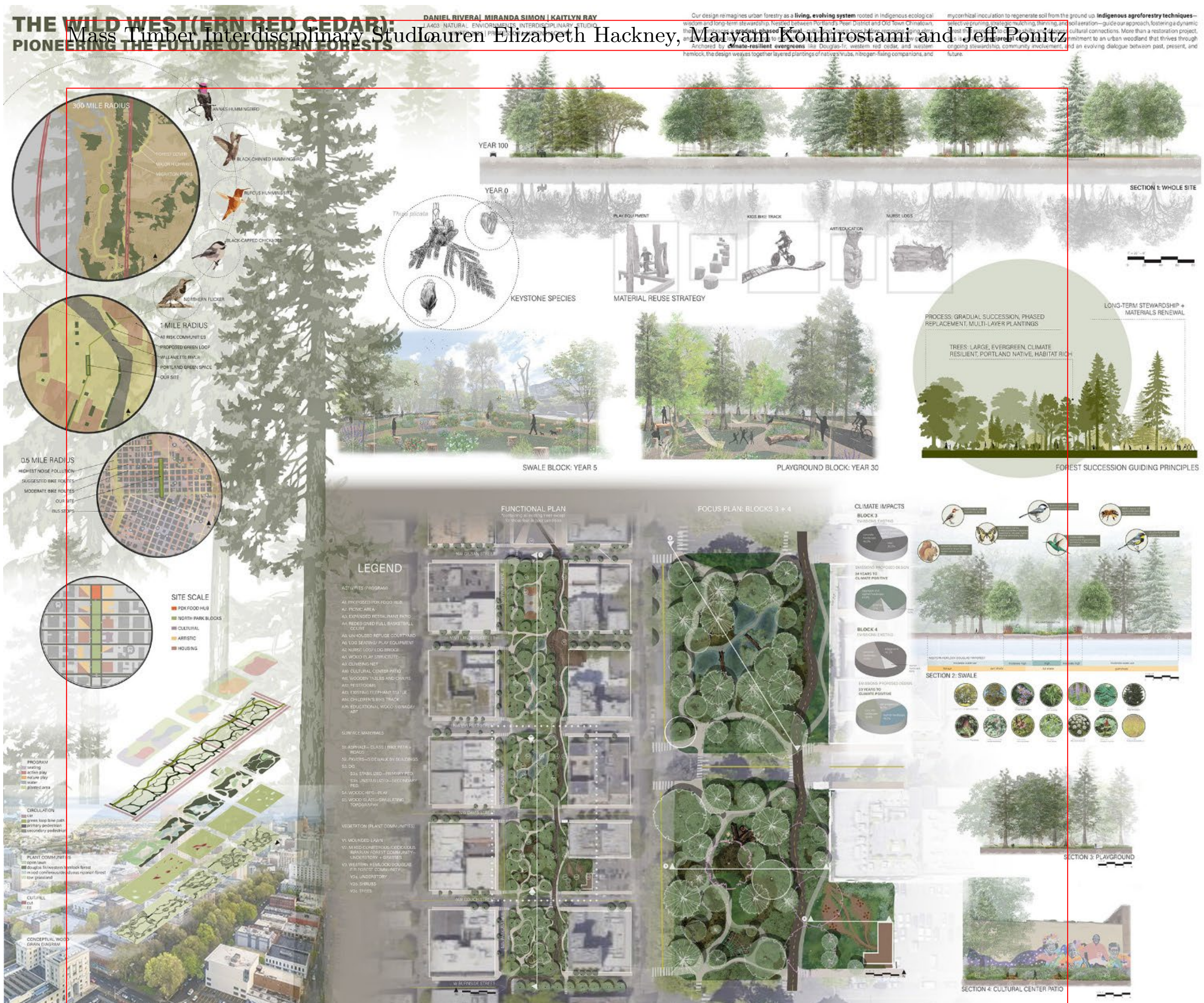

Figure 2: Example of North Park Blocks Final Interdisciplinary Design

Forest to Food to Frame: the North Park Blocks and Park Extension. Throughout the Studio, Landscape Architecture and Architecture students actively collaborated to address how the PDX Food Hub project, and the use of mass timber construction, could connect to and support an evolving public realm. Students redesigned the two parks surrounding the PDX Food Hub project site, the existing North Park Blocks and planned Park Extension (NPBx). Construction Management students then worked closely with Landscape Architecture students to estimate construction costs and sequencing.

Students focused on forests not just as a material resource (timber), but also as ecosystems (regional ecology and materialshed), and as community infrastructure (urban forest). Accordingly, students' design proposals for the existing North Park Blocks envisioned short- and long-term efforts to regenerate the park's significant but ailing urban forest while better addressing the needs of the park's surrounding communities in the Pearl District, Downtown, and Old Town Chinatown. Students addressed tree health, replacement and reuse, and design phasing based on the needs of existing trees, and were encouraged to create reciprocity (giving back to the forest) instead of commodity (using the forest) through actions of care: volunteer and stewardship programs, educational activities, job training, and innovative approaches to material selection and reuse. In designing the planned NPBx, a public park for the planned Broadway Corridor Neighborhood, students explored the site's potential to be an ecological and cultural catalyst through the PDX Food Hub and new public space that fosters connections to the historic North Park Blocks, the future Green Loop and Broadway Corridor, the surrounding city, and the region (Figure 1).

Communication: One Shared Language Across Disciplines

At Cal Poly, design studios traditionally emphasize conceptual and aesthetic exploration but often overlook the technical and procedural language central to construction practice—terms like scope, budget, or the distinction between soft and hard costs. This disciplinary gap, as Irizarry, Meadati, and Gheisari (2010) note, mirrors a broader challenge in Architecture, Engineering, and Construction (AEC) education, where curricula have been slow to integrate the communication and teamwork skills needed for contemporary interdisciplinary collaboration. Design students rarely engage in technical dialogues around cost estimation or constructability, while construction and engineering students often lack experience negotiating the design intent, ambiguity, and iteration inherent in creative studio processes. Brncich, Shane, Strong, and Passe (2011) argue that such gaps in vocabulary and process hinder students' ability to engage effectively in integrated project delivery models. Their study demonstrated that collaborative, cross-disciplinary learning environments—where construction management, architecture, and engineering students share a project framework—help cultivate mutual respect and a shared technical language that bridges conceptual and pragmatic approaches to design and construction. To address this divide, instructors adopted a series of integrative strategies—structured collaboration meetings, coordinated deliverables, and field-based learning—to foster communication and understanding across disciplines.

Weekly Collaboration Sessions. Students were organized into interdisciplinary teams of 6-8 students for the duration of their participation. Each team developed a single, integrated building and site design together. Teams met weekly to share their current work, address questions from other disciplines, and collaborate on key areas of the design established by the instructors, ranging from structural bay design and sizing to site circulation. While these meetings were most effective when the students were working on common deliverables, such as physical or digital models, new information and connections were discovered by students who were curious about their teammates' disciplinary focus and work processes.

Coordinated Deliverables. The instructors set up a schedule for students to share their work with their teammates from other disciplines in specific formats that mirror professional workflows. For example, Architecture and Landscape Architecture students were asked by their Construction Management teammates to prepare a specific set of drawings and responses to questions that informed benchmark cost estimates. While this added complexity to the students' collaboration that was challenging for them to manage, the coordinated deliverables enabled each discipline to present their work to a new audience that was unfamiliar with technical terms, jargon, and disciplinary shorthand. The authors noted this helped students clarify their intentions and questions while illuminating disciplinary differences.

Field-Based Learning. Industry partners invited the Studio to tour mass timber projects that were under construction or recently completed. Students visited a tech campus in Silicon Valley and a university residence hall in Santa Cruz, attending workshops on site that explained unique technical aspects of the buildings' construction and design processes (Figure 2). Seeing the crews, staging and equipment present during construction was particularly helpful in conveying the interdisciplinary nature of construction: material and equipment staging relative to existing tree protection, site circulation relative to adjacent buildings and campus needs, different phases of construction. Also, nearly all of the students had never visited a mass timber building; interacting with the material's texture, smell, and scale was a powerful learning experience, especially for non-Architecture students who previously understood the material only in quantitative terms.

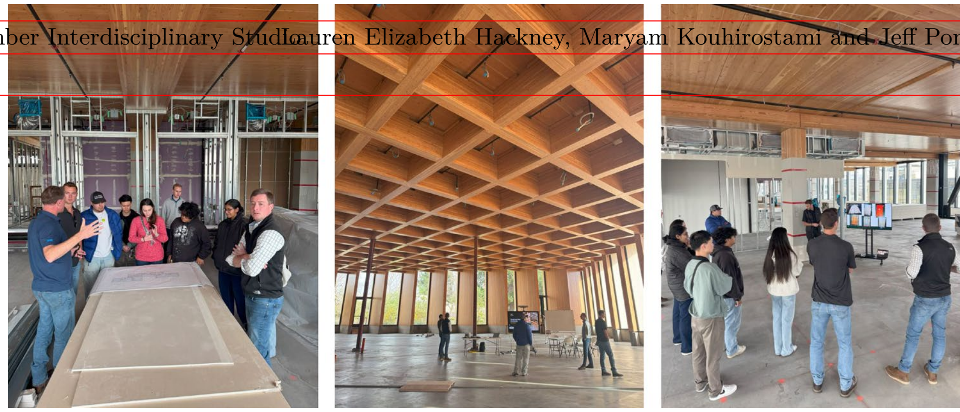

Figure 3. Field-Based Learning at Silicon Valley Tech Campus

Collaboration: Interdisciplinary Teamwork and Skill-Building

Like communication, teamwork and collaboration skill-building are crucial professional skills that are under-represented in professional undergraduate degree programs (Irizarry et al., 2010, p. 226). To help students build these skills, particularly around negotiation and time management, the instructors set up multiple ways for students to work directly together on collaborative exercises. These included building physical models and problem-solving activities as well as case studies and presentations (Figure 3).

Building Together: Physical Models and Icebreaker Exercises. Building together at a range of scales encouraged the students to find common ways of working and cross disciplinary boundaries. At the outset of the studio, teams were introduced to each other through rapid problem-solving icebreaker exercises such as the Marshmallow Challenge and a custom puzzle game. The College of Architecture and Environmental Design purchased a full-scale, 10’x10’ mass timber construction mockup kit designed and manufactured by Rothoblass for the Studio. Working together with their interdisciplinary teams and two instructors, students assembled and disassembled the kit over several weeks. As students encountered unexpected issues—such as missing components, misaligned panels, or ambiguous connection details—they were required to address these challenges through professional communication channels, learning how to formulate and submit Requests for Information (RFIs) to clarify design intent and resolve construction ambiguities.

Additionally, smaller groups of students built conceptual models of their design project site and building, and structural bay models of the building. These parallel modeling exercises allowed students to test and visualize ideas at different scales—from overall site context and spatial relationships to the finer resolution of structural systems and connections. The conceptual models helped teams translate abstract design and planning principles into physical form, prompting conversations about scale, orientation, and site response that linked architectural intent to construction feasibility.

Team Assignments and Presentations. The instructors utilized team assignments and presentations to foster interdisciplinary interactions. These included a series of mass timber case studies, through which students compared and contrasted a range of approaches and best practices for mass timber architectural and structural design, including how mass timber structural systems are sourced, designed, how they interface and integrate with other building systems, and how diverse stakeholders engage with mass timber buildings. One assignment challenged teams to develop an optimized framing strategy for a specific building type and form, prompting cross-disciplinary discussions about efficiency, constructability, and design intent. This process encouraged creative problem-solving and innovative thinking, as students negotiated design priorities and structural performance within realistic constraints.

In the second half of the course, each interdisciplinary team completed a comprehensive midterm and final project, culminating in collaborative drawings, digital models, and a coordinated construction proposal package. Teams were required to synthesize architectural, structural, and construction management perspectives to produce a unified design-build submission for a hypothetical client, mirroring real-world integrated project delivery (IPD) processes. Each team formally presented their proposal through oral presentations and visual documentation, articulating the collective rationale behind their design and technical decisions. This capstone experience reinforced the importance of clear communication, role definition, and professional coordination—skills essential to interdisciplinary mass timber practice—and resulted in a cohesive, well-documented proposal package that simulated a professional mass timber project.

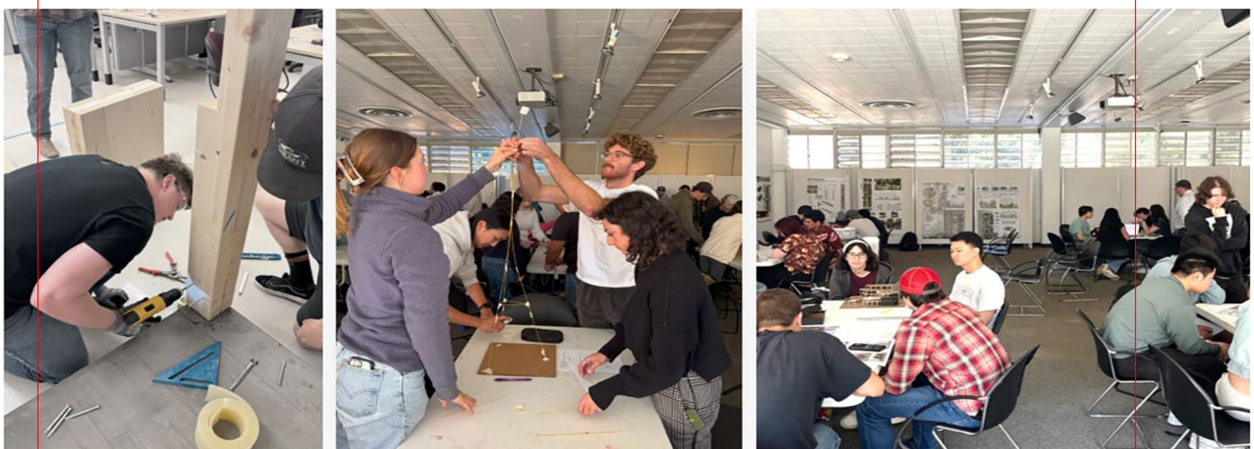

Figure 4. Students participating in Mockup Kit, Marshmallow Challenge, and Weekly Sessions

Reflections

Exploring Mass Timber construction through interdisciplinary collaboration is a subject and pedagogical structure that the authors remain enthusiastic about and would describe as a qualified success, with room for improvement. The authors note that there is an opportunity to build on the strengths of the Studio, as described by the student responses below, while more clearly defining for them the necessity for, and means of, effectively working across disciplines.

Course Structure. Our first reflection applies to educators considering similar collaborations. For the first instance of the Studio, ninety-nine participating students were enrolled in five separate courses listed by their respective departments, each with its own learning objectives and requirements in addition to the shared requirements of the Mass Timber Interdisciplinary Studio. For example, eighteen architecture students designed one integrated project over two quarters; twenty-nine landscape architecture students designed one-quarter projects at different scales; forty-six Construction Management students focused on project management and delivery; six Architectural Engineering students took the course on as a capstone project. This structure, necessitated by degree requirements, was overly complicated and reinforced a sense of “my class/project” versus “our project”. One student evaluation noted, “*It was difficult to work with a full team, because everyone had different deadlines and requirements, and sometimes one discipline needed something from the other, but they didn't have it yet. I loved the field trip experience and interdisciplinary collaboration. I also liked that we were able to work in a different context and scale than we were used to*.” Though the authors found the students’ experience mirrored our own professional silos, we felt an opportunity was missed to formalize, through the structure of the course, the ways in which emerging knowledge about sustainability and innovation often exists between disciplines and not within them. Components of the course that students found especially helpful in fostering interdisciplinary interactions included field trips, shared assignments such as models and case studies, and focused collaboration sessions. Structuring these shared components of the Studio as a cross-listed interdisciplinary class with its own unique learning objectives would be an important step for the success of future iterations.

Collaboration Skills and Expectations. Second, the authors found that students' own expectations about design collaboration influenced whether their experience was positive or negative. There was more interest in having other disciplines "understand what we do" -- again, reifying disciplinary boundaries – than curiosity about other disciplines or a shared collaborative process. Students who were interested in specific aspects of other disciplines tended to view the Studio and interdisciplinary work more positively. One noted, "*I thought it was really cool to work with other majors and see how a project is actually built/managed*." Another described "*working on the physical model at the beginning of the quarter [as] the best collaborative work we did. Having the same deliverable was great, because we were forced to be in the same room together to work, accomplishing the same task."* For the authors, this dichotomy reflects a broader need for AEC programs to acknowledge that skill-building in collaboration, teamwork, and interdisciplinary problem-solving in our fields is foundational and can't be instilled only in a single upper-level course.

Students' collaboration skills were evaluated through pre- and post-course surveys measuring self-assessed confidence across communication, teamwork, and interdisciplinary coordination. Results indicate clear and measurable improvement across these domains, with the most significant gains in verbal communication, team coordination, and conflict resolution—skills central to effective interdisciplinary practice. Overall, the post-course results show that structured, integrated, and task-based collaboration experiences significantly enhance students' confidence in cross-disciplinary teamwork and communication (Table 1).

Table 1

Top 5 Skills Showing the Greatest Improvement in Student Confidence (Pre- and Post-Course Comparison - 46 CM students)

Skill	Pre-Course Confidence (%)	Post-Course Confidence (%)	Increase (%)
Delegation and task management	52.9	85.7	32.8
Ability to work effectively as part of a team	58.8	78.6	19.8
Verbal communication	47.1	64.3	17.2
Conflict resolution	41.2	57.1	15.9
Ability to receive constructive feedback from team members	70.6	78.6	8

A self-evaluation at the end of the Studio asked 32 Landscape Architecture and Architecture students several free-response questions to evaluate how their collaboration skills changed over the course. Their responses were analyzed thematically in alignment with the Skills in Table 1. This analysis by the authors indicated that 75% of surveyed students felt their ability to work effectively as part of a team improved, with 83% noting more confidence in verbal communication and sharing constructive feedback and 67% noting improved conflict resolution, delegation and task management. The authors plan to create one consistent pre- and post-course self-evaluation rubric and survey for every participating student in future iterations of the Studio.

Industry Partnerships. A highly successful aspect of the Studio was the willingness of AEC industry partners to share their time and expertise with the students. This allowed the students to build connections with forward-thinking professionals that, for some, will align with their future career trajectory. The collaboration with industry partners through the Studio – General Contractors, Architects, Landscape Architects, Engineers, Fabricators, and Suppliers – gave the students both broad and deep knowledge on topics ranging from forest stewardship and economic impacts to fabrication, construction, and material life cycles. The authors offer that this type of industry-academic collaboration will be essential in achieving shared climate goals for the built environment. Both the AIA (American Institute of Architects) and the ASLA (American Society of Landscape Architects) have outlined ambitious goals for the practitioners in their respective disciplines in Climate Action Plans that culminate in the year 2040. The success of these multi-year plans will depend on today's students, who will be 2040's mid-career practitioners, and their interdisciplinary knowledge of innovative construction types such as mass timber that can contribute to carbon sequestration, reduce emissions, and transform our practice.

In addition, student reflections highlighted the strong impact of industry partnership on their learning. Guest lectures on mass timber design and construction were praised for bridging academic theory with industry practice, reinforcing the interdisciplinary focus of the studio. They mentioned *"The faculty member provided many opportunities to connect with industry professionals who spoke on the course topics."* Likewise, the mass timber field trip stood out as one of the most memorable and educational components, allowing students to visualize construction processes and material applications firsthand. One student mentioned that *"I liked having the mass timber field trip, it helped me visualize and see the aspects of what really goes on a mass timber project site."* Overall, students valued these applied learning opportunities and expressed interest in expanding both industry engagement and field-based experiences in future offerings.

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