

A Focus on Pedagogy

2025

AMPS Proceedings Series 47.1

Emerging Theories, Teaching & Technologies

AMPS PROCEEDINGS SERIES 47 v1

Leeds Beckett University, UK | Marywood University, USA | KU Leuven, Belgium

19 – 21 November, 2025

A Focus on Pedagogy

Emerging Theories, Teaching & Technologies

ARCHITECTURE_MEDIA_POLITICS_SOCIETY
Amps

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AMPS PROCEEDINGS SERIES 47. ISSN 2398-9467

INTRODUCTION

A Focus on Pedagogy

Emerging Theories, Teaching & Technologies

Academia: the epitome of an ‘ivory tower’. A bastion of siloed thinking. Distanced from the ’real world’. The criticisms of what we do as educators can be cutting. However, today, many identify that academia is ‘turning outwards’. No longer beholden to established practices, it is increasingly diverse and varied. We see this in student focused learning. We see it in problem-based learning. We see it in the embracing of AI. We see it in the areas we are supported to research, and the partnerships we are encouraged to make.

From a pedagogical perspective, this outward turn is accompanied by our own developments, like the rejection of ‘single size’ teaching styles, projects ‘relevant’ to the modern student, and academic-industry partnerships connecting with the ‘real world’. Inside the academy we are pioneering new technologies and experimenting with educational psychology. We are pushing the boundaries of what we understand teaching and learning to be. We are influencing the world outside. The result of all this, is a modern academy that is complex, nuanced and cutting edge.

Reflecting on this, the Focus on Pedagogy 2025 conference, Emerging Theories, Teaching & Technologies, explored a multitude of issues informing contemporary academia. As a result, the papers included in this volume deal with emerging approaches to teaching and learning. They examine the effects of the digital turn, critique evolving research agendas and fields and present case studies of individual classes. Seeking to instigate debate on connecting communities, professionals and students they examine how we can best support our students – through both the changing terrain of learning, and their life outside the academy. This particular issue focuses on the disciplines of the built environment, particularly architecture and urban planning.

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INSTRUMENTS OF SOCIO-SPATIAL PRACTICES- METHODOLOGICAL OPPORTUNITIES UTILISING VISUAL ANTHROPOLOGY IN ARCHITECTURAL RESEARCH-BY-DESIGN INQUIRIES

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INTRODUCTION

Social Sciences and Architectural Education: Traps and Opportunities

The paper explores the creative capacity and instrumentalisation potential of integrative approaches to research-by-design methods in architecture. We present the outcomes of a transdisciplinary pedagogic experiment carried out at the Liverpool School of Architecture's Master of Architecture Programme, as part of the *Research-by-Design Methods* course which involved over one hundred students between 2020 and 2025. By triangulating anthropological methods, spatial production, and research practices, the results point towards new frameworks of socio-spatial enquiry. The findings of this experiment contribute to emerging theories of interdisciplinary pedagogy by demonstrating how visual methods operate as learning devices rather than representational tools. We argue that visual anthropology can function as a pedagogical instrument for shaping research-by-design teaching, turning a linear problem-solving model into an iterative, reflexive learning process.

Social sciences were hugely influential in post-war architectural education.[1] Driven by a desire to address social problems, such as housing and urban redevelopment, architectural schools in the United States and Europe began incorporating social science into their curricula to better understand the relationship between buildings and their users. By the 1970s, sociologists were faculty members of the most prestigious architectural schools in the UK.[2] In this period, various methods of sociological analysis were introduced, to connect design projects to "real world" scenarios. This ethical perspective was justified by wider calls to social engagement in the profession, and a functionalist approach to design. In the 1980s, some critics of this application of social sciences claimed that this form of interdisciplinarity was limiting, formulaic, ultimately hindering design innovation and formal expression in architecture. [3]Others pointed in the exact opposite direction, by arguing that sociologists and academics used theory as a "refuge of obfuscation" from professional commitment to the real-world and the welfare of the public.[4]

While it is debatable whether these earlier examples of integration of social sciences to the design curriculum were truly interdisciplinary endeavours, their impact on human-centric, modern architectural design education are undeniable.

In setting up our pedagogic experiment, we aimed to avoid the formulaic traps of the past, when sociological inquiries were employed in the analytical work that preceded and informed the design process —to contextualise design "problems" and, or to "justify" solutions. Our ambition was to explore the full creative potential of these collaborations in mobilising a methodological exchange — and test how their processes and ideas can be integrated— in the context of current educational trends of learning ecologies. We were driven by our belief that, in the era of increasing fragmentation of knowledge,[5] methodological instruments become crucial in connecting the dots.

PEDAGOGIC CONTEXT

Research-by-Design Methods

In 2020, we set up a series of experimental workshops as part of a semester-long *Research-by Design-Methods* course leading to thesis design. As part of their thesis design projects, students were tasked to develop design-driven spatial research. Such research had to be simultaneously experimental and rigorous, and it had to respond either to topical questions, or speculate on solutions for anticipated issues. The experimental process was ensured by finding the right research tools. The research tool was defined as a medium through which the thesis was represented and by which the discourse was constructed.[6]

To help students develop their own design methodology, relevant to their chosen topic, students were offered a series of experimental workshops such as *Visual Anthropology, Data Visualisation and Cartographies, Analytical Film,* just to name a few. The workshops were organised halfway through the course —intentionally disrupting the research process, allowing students to branch out and test their hypothesis utilising various disciplinary methods, media and sources. This interdisciplinary set-up introduced a variety of research tools and instruments ensuring a rich, rigorous analytical process. Students had the opportunity to use various forms of media to analyse and test and represent the spatial, social, political and environmental aspects of their projects.

Within the framework of a visual anthropology workshop, the students kickstarted their research by collecting and organising visual material(data) to establish and frame the field of their inquiry.

The tableau (*Figure1)* below illustrates the first step of an investigation on how vulnerability is portrayed in the media, as part of a wider study on transgender women's safety in urban spaces. The tableau is a visual data repository. The format intentionally emphasises the rawness and the immediacy of this preliminary image search.



Figure1. Tableau of Vulnerable London by Amber Potts

Visual Anthropology Workshop, Agenda and Goals

The workshops explored the ways in which cultural anthropological approaches and methodologies can serve the creative production of research-by-design processes. The emphasis was on applying anthropological knowledge to architectural inquiry, connecting social and cultural practices to their chosen area of investigation. The workshops introduced the field of visual anthropology, focusing on both its theoretical and the practical aspects.

We approached the "visual" as a way of thinking,[7] as a creative tool, and a technique of representation. We worked with existing images and visions as our main primary tool for data collection, data analysis, and interpretation of results and findings.

The workshop introduced qualitative methods and practices, using cultural anthropological and visual perspectives to help students navigate different cultural contexts.

We looked at the visual representations of cultural phenomena and the cultural interpretation of visual representations[8] through case studies.

During the workshop student groups formulated their own interdisciplinary discourse in the form of an original methodology based on socio-scientific approaches and as part of a collaborative creative action. The goal was that participants would be able to conduct a critical image-based analysis, understanding the limitations and benefits of using photography or film in anthropological data collection.

The activities included: (1.) *participatory field work,* (2.) *diary-making* in the form of a visual blog, (3.) *critical research proposal* writing, (4.) *co-creative visual project design.*

TRADING ZONES: VISUAL ANTHROPOLOGY as SPATIAL ANALYSIS and SPATIAL ANALYSIS as VISUAL ANTHROPOLOGY

"Two groups can agree on rules of exchange even if they ascribe utterly different significance to the objects being exchanged; they may even disagree on the meaning of the exchange process itself. Nonetheless, the trading partners can hammer out a local coordination, despite vast global differences. In an even more sophisticated way, cultures in interaction frequently establish contact languages, systems of discourse that can vary from the most function-specific jargons, through semispecific pidgins, to full-fledged creoles rich enough to support activities as complex as poetry and metalinguistic reflection"[9]

The aim of our study was to explore collaborative methods that enable the co-production of knowledge between architecture, anthropology, and the arts, seeking to answer the following question:

How can the methodological exchange between architectural design and visual anthropology foster new frameworks for understanding and designing social spaces?

The theoretical framework drew on the fields of sociology and visual anthropology, situating architectural design as both a spatial and cultural act. The deconstruction of the disciplinary frameworks demands experimental forms of communication, where tools and media not only represent knowledge but actively shape it. Galison, in his seminal work on multi-disciplinary collaboration[10] uses the metaphor of *trading zones* to identify the place where the interchange of collaboration occurs. In our search for new collaborative modes of communication, we found "trading" in zones of disciplinary interchange which were both procedural *(How do we work?)* **and linguistic** *(how do we talk about it?)*.[11]

PROCESS OF INQUIRY

To illustrate the process, we will use the above cited project as an example. The research titled *An Urban guide to Transgender Woman's Safety,* began with an auto-ethnographic enquiry conducted by the student —herself a transgender woman— in the streets of the east London neighbourhood of Dalston. Such enquiry resulted in a formulaic translation of her experiences, which were summarised in the form of a manual. The booklet became both an architectural guidebook and a pamphlet of advocacy. While the booklet as an outcome of the inquiry was seemingly linear, the process was far from sequential. Despite being conceived as an attempt to retrospectively lay out the development of the process as a series of consecutive steps, the five diptyques below revealed a circular, iterative process. The word pairs speak of a dialogue of (inter-disciplinary) actions:

1.investigation-assumption

The increasing mediatic depiction of atrocities committed against transgender women were tested against trends of global statistics of transgender porn consumption.



Figure 2. Perceived Danger and Statistics in An Urban Guide to Transgender Women's Safety by Amber Potts

2.analysis-test

Screenshots of a documentary capturing the gaze of people looking at transgender population and testing the visibility of faces in crowds facing direct and indirect sunlight.



Figure 3. Glare Study and Gaze in An Urban Guide to Transgender Women's Safety by Amber Potts

3.findings-conclusions

Articulating the relationship and impact between visual perception such as reflection (sheen of material surfaces) or obstructed field of vision, and the perception of fear and exposure.

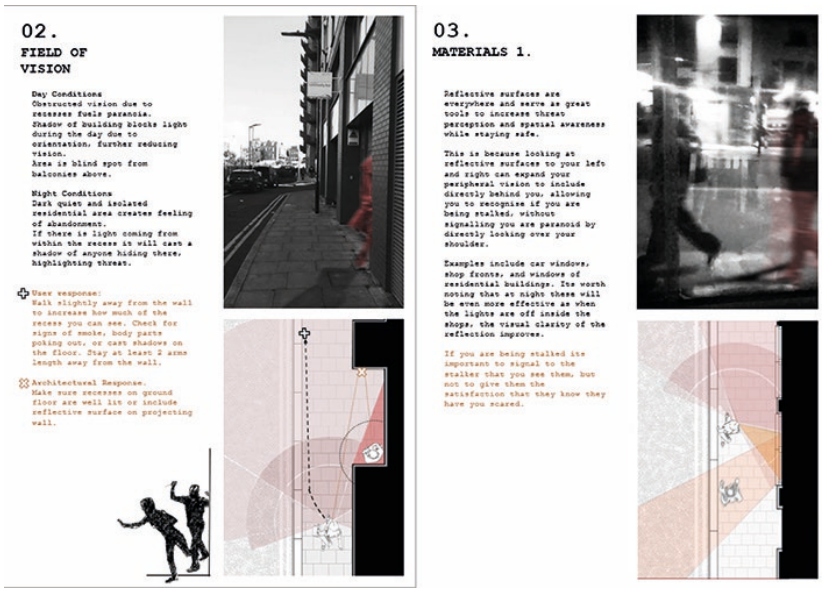


Figure 4. Field of Vision and Materials in An Urban Guide to Transgender Women's Safety by Amber Potts

4.interpretation-representation

Positioning and formatting the research: language of advocacy. Identifying who is it for? Who are the agents and stakeholders?



Figure 5. Perceived Danger and Statistics in An Urban Guide to Transgender Women's Safety by Amber Potts

5.reflection-impact

The discourse on safety is framed by the idea of paranoia.



Figure 6. Front and back pages of An Urban Guide to Transgender Women's Safety by Amber Potts

By superimposing two disciplinary modus operandi, traditional linear developmental stages of inquiry involving —such as ***investigation-assumption, 2. analysis-test, 3. findings-conclusions, 4. interpretation-representation, 5. reflection-impact***— *were* turned into an iterative loop. The various iterative stages became an investigation on representation where ***tools, media and sources*** were interchangeable.

To illustrate this, we use the following four student projects to show how various disciplinary methods were utilised; what sources they relied on for their research; what interpretations and conclusions their findings prompted; and in what format their design findings were communicated.

These investigations are vastly different in their scale and theme of inquiry. As means of comparison, we looked at what anthropological method, *source or data, medium* or *tool* were utilised; what *outcome* or *findings*, *conclusion* or *interpretation* did they lead to; and what *format* or *design* shaped the communication of the findings. Since some of these are bifocal procedural terms that highlight the disciplinary shifts between architecture and anthropology, they were also instrumental in the creative dialogue between pedagogy and research. As an example, the research *tool* functioned simultaneously as a *design medium* and as a pedagogical instrument through which learning and reflection were structured.

As a first step, each group of students re-formulated their architectural research question with an anthropological focus, shifting the protagonism from space to people.

A project on urban domesticity investigated the conditions of migrant workers in Hong Kong. Students posed two questions referring to two different groups of migrant workers:

How and where do migrants without a bedroom sleep?

How and where do migrants without living rooms socialize?

Prompted by the first question, they investigated a group of temporary migrant workers, coming largely from mainland China, referred to with the derogatory term: “mcrefugees”(*Fig 7)* [12]As their method of investigation, they adopted behavioural analysis, collecting primary data through participatory observation. Fieldwork became their primary source of data collection, utilising video recordings both as an observation medium and as an analytical tool. The outcomes regarding the first question led to findings on who, when, where and how people occupy the 24-7 fast food joints. In the conclusions to their research, which were represented in the form of a comic book, the 24-7 fast food joints were interpreted as public bedrooms showing patterns of spatial appropriation.



Figure 7. Mcrefugees in Macdonaldland by Yifan Lu,Yu Zhan, Juxuan Wang

In response to the second research question, the focus shifted to domestic workers, primarily from the Philippines, and their use of public space on their rest-days” (*Fig 8*). The investigation relied on fieldwork as the primary source of data; however, in this case participatory action research was combined with spatial intervention. Photography, sketching, and diary-making were the main research tools through which observations were recorded and analysed. The collected images, drawings and notes documented who participated in these gatherings, where and when they took place, and how they were organised. The findings revealed how the workers temporarily appropriated parks and

residual spaces beneath overpasses, transforming them into shared “public living rooms.” The interpretation of these spaces foregrounded their ritualised character as sites of pop-up reunion—assembled, inhabited, and dismantled within a single day. These portable spatial practices, constructed from personal belongings and recycled cardboard, were subsequently translated into the comic-book format, which continued to evolve as part of the students’ design inquiry.



Figure 8. Urban Living Rooms in Macdonaldland by Yifan Lu,Yu Zhan, Juxuan Wang

The next case study explored the multiple identities shaping the difficult heritage of Mostar” (*Fig 9*). To anchor this layered, complex topic in spatial terms, two key research questions were asked:
Who lives where, and why?
What parts of the city do they connect with, and how?
This inquiry sourced social media (Instagram) data and statistical surveys, using images and text as the methodological materials. To assess this vast amount of information, GIS mapping was also employed as a secondary method of data analysis and classification. The juxtapositions of these methods yielded findings painting a misalignment between administrative and spatial boundaries of neighbourhoods. The students were able to map the physical and the conceptual boundaries, as well as how residents and tourists from different backgrounds attribute value to specific locations and buildings. Rather than treating heritage as a fixed category, the study reframed “difficult heritage” through spatialised identities. The format of the outputs were mass data archives classified into atlases and maps.

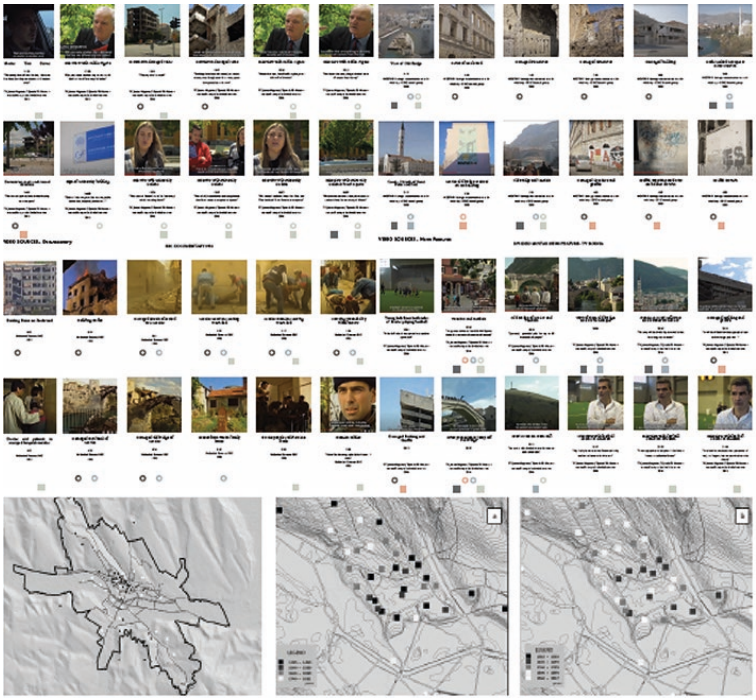


Figure 9. Identities of Mostar in Uncommon Ground by Heather Coleman,Julia Grzesiak, Chetan Karadia, Alice Lilley

Looking towards historical examples is not an obvious focus of anthropological enquiry. The project, titled *Industrial Domesticity*, used archival image analysis as a method to re-capture the life of workers in the historical industrial town of Port Sunlight in the late 1900s (*Fig 10*). By assessing archival film footage records as their primary source, the students developed a map which identified the locations of the workers' daily, weekly, and seasonal routines and rituals. Based on the map, they found the original plans of these locations which they deployed to test and reenact the possible use and organisation of space at various scales (including one-to-one). By reconstructing these spaces, the outcome of the research was able to distinguish the communal from private areas, how these spaces were used, and why. The conclusions included speculations on each examined spaces' capacity for various forms and scales of social interactions. The findings were classified at different stages of the research and were ultimately organised in a complex atlas which included screen captures of both the portrayal of activities from the archival footage, and the reenactments in the form of annotated plans.

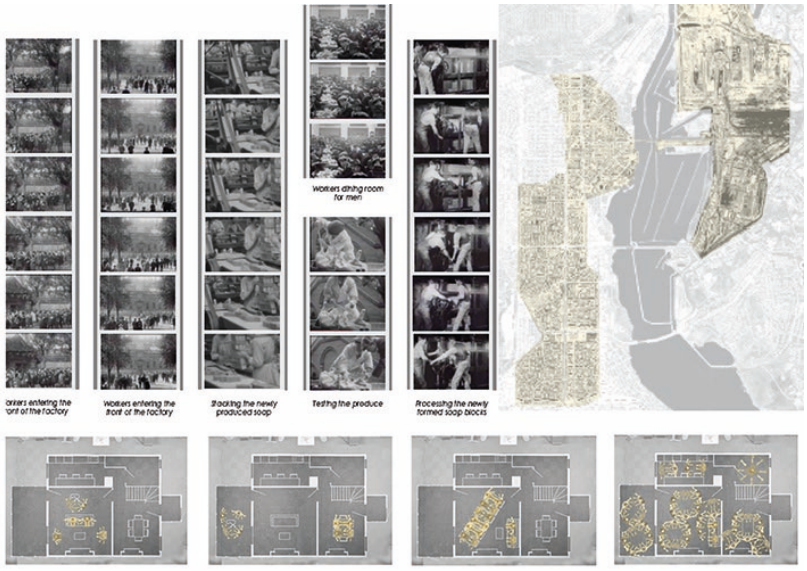


Figure 10. Port Sunlight's Rituals in Industrial Domesticities
by James Bower, David Grant, Walid Al Jaber, Lewis Washington

OPERATIONAL GLOSSARY, TERMS OF AMBIGUITY

For this cross-disciplinary interchange to work, we identified a glossary of terms, which became essential to our ongoing development of an operational *language.* This glossary has been evolved through transitioning between terms of architecture, art and social science.

Each term has distinct meaning(s) in its own respective field of knowledge; and for some terms, different domains of knowledge attach different meanings to the same term.

It is also important to highlight that the ambiguity of meaning derives from the ambiguity of the disciplinary status of the involved fields, namely: *art, architecture, and anthropology*.

From a strict methodological perspective, art is often positioned as a practice-based or transdisciplinary field rather than a single bounded discipline. Architecture, by contrast, operates as an integrative creative practice that is inherently multi-disciplinary, while anthropology is generally situated within the social sciences as a distinct disciplinary framework.

Within this context, terms, such as *site*, *field*, *dimension*, or *perspective* — each holding divergent meanings across disciplines— were "traded" and redefined collaboratively. These terms were *lost and found* in translations, and they were operationalised in the creative process through misunderstandings, mis- and re-interpretations.[13] For this ambiguity and creative confusion to work, the terms of use became project- specific.

The research projects and their creative processes set the limits of the above-mentioned "trading zone", where these terms and their meanings gained temporary and situated stability.

CONCLUSIONS

In each research project, the operationalisation of the above terms (and their multiple meanings) allowed to mediate the complexity of the studied place, or phenomenon.

Our findings suggest that integrating architectural and anthropological methodologies reshapes the research process into a circular model, in which representation, interpretation, and design co-evolve. The paper illustrates how these situated methods are generating both conceptual and linguistic tools for collaborative creativity and propose new methods and strategies for interdisciplinary research in design and architecture.

By positioning visual anthropology as a pedagogical instrument, this study contributes to emerging theories of interdisciplinary learning in design education.[14] Beyond architectural education, this pedagogical framework can be transferred to other practice-based disciplines engaging with complex social contexts. In urban studies, for example, image-based fieldwork and visual diaries can support the analysis of lived spatial experience. In visual culture and media studies, similar methods enable critical interrogation of representation and visibility. Within participatory social research, pedagogical trading zones provide a structure for negotiating disciplinary methods and terminologies. By framing research tools as pedagogical instruments, the approach supports iterative, reflexive learning processes applicable across interdisciplinary higher education contexts**.**

NOTES

[1] John Zeisel, *Sociology and Architectural Design*, Social Science Frontiers (New York: Russell Sage Foundation, 1975).
[2] As prominent UK schools we refer to architecture schools which are either part of research universities or have strong research and experimental profile.
[3] Andrew Barry, Georgina Born, and Gisa Weszkalnys, "Logics of Interdisciplinarity," *Economy and Society* 37, no. 1 (2008): 20–49, https://doi.org/10.1080/03085140701760841.
[4] Peter Buchanan, "What's Wrong with Architectural Education? Almost Everything," *The Architectural Review* 185, no. 1109 (July 1989): 24–26.
[5] Ashraf M. Salama, "A Decolonised Architectural Pedagogical Framework: An Imperative for Reform," in *Learnings/ Unlearnings Reader #3: Emancipating and Emancipated Pedagogies – Decolonising and Co-creating Our Future Built Environment*, ed. Ashraf M. Salama and Merike Schalk (IAPSIS The Swedish Arts Grants Committee's International Programme for Visual and Applied Art, 2025), 3–7.
[6] Pieter Jan Stappers and Elisa Giaccardi, "Research through Design," in *The Encyclopedia of Human-Computer Interaction*, 2nd ed., ed. Mads Soegaard and Rikke Friis-Dam (Interaction Design Foundation, 2017).
[7] Sarah Pink, *Doing Visual Ethnography*, 3rd ed. (London: Sage, 2013).
[8] Jay Ruby, and Marcus Banks, eds., *Made to Be Seen: Perspectives on the History of Visual Anthropology*. (Chicago: University of Chicago Press, 2011).
[9] Peter Galison, *Image and Logic: A Material Culture of Microphysics* (Chicago: University of Chicago Press, 1997), p. 783.
[10] Peter Galison, *Image and Logic: A Material Culture of Microphysics* (Chicago: University of Chicago Press, 1997).
[11] Harry Collins, Robert Evans, and Michael Gorman, "Trading Zones and Interactional Expertise," Studies in History and Philosophy of Science 38, no. 4 (2007): 657–66, https://doi.org/10.1016/j.shpsa.2007.09.003.
[12] The local term refers to temporary workers, who in lieu of access to affordable temporary accommodation would take shelter at 24-7 fast food joints, such as McDonalds.
[13] Barry, Born, and Weszkalnys, "Logics of Interdisciplinarity," 20–49.
[14] Wendy Gunn, Ton Otto, and Rachel Charlotte Smith, eds., *Design Anthropology: Theory and Practice* (London: Bloomsbury, 2013).

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EMBODIED PRODUCTION OF KNOWLEDGE: A FEMINIST LEXICON FOR SPATIAL DESIGN PRACTICE

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INTRODUCTION

Architectural and urban design education has long been framed as a rationalist, technical, and formalist endeavour,[1] underpinned by pedagogical logics that privilege instrumental epistemologies of linear progression—from problem to solution—largely insulated from social, political, and environmental contingencies.[2] Up until today, design practices frequently become calculative and solutionist, marginalising the social, political, affective, and relational dimensions through which urban life is produced, contested, and lived. Feminist, decolonial, and critical pedagogies, by contrast, have persistently challenged this model for reproducing hierarchical power relations and epistemic exclusion, calling instead for more situated, dialogic, and collective forms of learning.[3] These approaches insist that design pedagogy must be responsive to its social, environmental, and political contexts, while also confronting broader questions of justice, power, and responsibility.[4] Building on these traditions, the Spatial Design Practices module in the MSc Building and Urban Design in Development (BUDD) at the Development Planning Unit (DPU), provides a space for advancing an embodied pedagogy grounded in a feminist lexicon of care, collectivism, and resistance. Operating through four interwoven frameworks— *Dislocating/Decentering, Pluralizing, Decolonizing, and Reorienting*— the lexicon refuses the spatialisation of aesthetic formalization, racialized extraction, patriarchal practices, and securitized politics that characterise much of mainstream design practice. It rather reworks design as a critical, relational, and politically situated practice, that disrupts and unsettles disciplinary and institutional boundaries of spatial design.

At the heart of our pedagogy is the studio, conceived not as a closed site of expertise but as an open setting in which meanings, concepts, experimentations, and practices unfold incrementally. Through a transdisciplinary teaching format, the studio enables a productive engagement with entanglements and multiplicities across a range of practices, including Making Workshops, Urban Design Otherwise (UDO), and Overseas Practice Engagements (OPE) which are all connected through the urban design research. Based on the ethos of co-teaching, these practices challenge imperial and Western authority over knowledge production by incorporating in-situ intellectual and political traditions of social justice movements, and by repositioning learning as a shared process with those already theorising, organising, and transforming urban space from below. As part of this endeavour, through a shared practice with students, staff, allies in a variety of contexts, we have developed a feminist lexicon that entails conceptual extensions such as *rupture, holding, belonging, out of place and polyphony*,

operating simultaneously as part of the practice and pedagogy development. Attending to these extensions requires understanding the sites of engagements beyond their physical limits and recognising that materials, bodies, and spaces are not fixed entities but are continually lengthened, stretched, and deferred into improvised spatial formations. In this paper, we present the lexicon and reflect on our process of co-authoring it. We aim to show how it foregrounds diverse, multiple, and translocal spatial dynamics and recalibrates urban design education as an open-ended, processual, and ethical practice. We start by situating engagement and pedagogical practices in the design studio within the four interwoven frameworks. This is done by explaining how students learn about the heterogeneous and overlapping spatial forces in contested territories through practices that reveals the otherwise character of these spaces. In the final section of the paper, we discuss how our feminist lexicon operates as a set of practices that enables students to question, re-think, un-learn, and re-configure urban conditions through embodied knowledge, political struggle, and spatial imagination, in the pursuit of more just and liveable urban futures.

Four interwoven frameworks of BUDD feminist lexicon

Dislocating/Decentering involves critically challenging dominant epistemologies in urban knowledge by reorienting how power, place, and social hierarchies are understood and represented. It is a process that makes visible the structures, narratives, and assumptions that underpin urban design, offering alternative perspectives that decenter Eurocentric and normative frameworks. *Dislocating/Decentering* reveal a profound interest in the margins, the souths, the peripheries, the outcast, and everything that is othered through dominant frameworks. Its about a design pedagogy that moves away from the comfort (for some) of the canon, convention, norm, and standard, focusing instead on the non- and the more-than. We focus on the hidden, the invisible, and the excess, the exuberant. We design for and with the peripheries, embracing the margins as sites of radical openness.[5] In doing so, we disobey cardinal hierarchies of north, south, east, and west, recognizing instead multiple "Souths" everywhere. Decentering pedagogy positions the peripheral as generative, foregrounding otherwise epistemologies sitting in the uncomfortability of the comfortable. It also encourages continual interrogation of the norms and assumptions that shape urban knowledge, revealing sites of possibility where alternative social, spatial, and political arrangements can emerge. In this way, the margins are not only sites of critique, but also of invention, experimentation, and transformation.

Pluralizing in our pedagogy moves in multiple directions. It is not only about diversifying the ways we learn, but also about critically – and constantly - reflecting on how we learn. Pluralising implies interrogating how knowledge is produced—by whom, why, and also in what ways the process of knowledge production shapes the classroom. From the first days of collective work to the subjective encounters with the material and social complexities of the city, we are constantly knowing differently and producing knowledge multiple while being conscious of it. Pluralizing in this sense emphasizes that knowledge is never fixed, never a given, never a singularity; it is always a becoming with, being produced and reproduced in diverse ways, often changing both the selves and the places with which we engage. It is also the measure of our dependence on others "We are fully dependent on each other for the possibility of being understood and without this understanding we are not intelligible, we do not make sense, we are not solid, visible, integrated; we are lacking."[6] Pluralising is also expressed in how we capture and communicate knowledge, from presentations to collaborative exercises, and in how we embed multiple epistemologies and cultural perspectives into the process. Pluralizing allows us to navigate conflicts of rationalities, embrace dissent, and cultivate design as multiple. It reflects a pluriverse of design thinking—where there is no single history, past, or future, and no possibility of a

single, unified synthesis. Pluraising design cultivates attentiveness to difference, uncertainty, and complexity, fostering engagement with spaces, people, and social relations in ways that are relational, open and procedural.

Decolonizing pedagogy challenges the legacies of colonial power embedded in knowledge production, design practices, and teaching methods. It involves asking whose knowledge counts, whose voices are represented, and whose histories are erased or marginalized—both within the design process and within the classroom itself. Who is not speaking? Who is not raising their hand? These questions extend from the "case study" to the intimate dynamics of group work, becoming more than a task—they transform into everyday practices and internalized gestures. In practice, decolonizing pedagogy for us not only means questioning dominant theoretical frameworks, liberating the curriculum, and prioritizing local, indigenous, or "grey" literature; it also and especially requires creating space for ongoing critical reflection on power, positionality, and privilege within the classroom, collaborative exercises, and site engagement – this extends to the teacher-student relations too In the studio, students are partners in the process of unlearning, releaning and learning anew. In practice, this involves collaborative, participatory approaches that redistribute authority (as much as expertise) between educators, students, and communities. This implies also confronting the institution, or at least, helding it constantly accountable for the production of reparative knolwdge, "For the master's tools will never dismantle the master's house."[7]

Reorienting draws on Sara Ahmed's concept of orientation, showing how space, knowledge, and bodies are differentially aligned.[8] Institutions and planning regimes operate as spatial technologies that naturalise order, extraction, and hierarchy, entangled with racialised histories that have produced Black and other marginalised bodies through slavery, racial capitalism, and dispossession.[9] Orientation reveals how access, legitimacy, and mobility are unevenly distributed, and how institutional and spatial boundaries are contested and resisted. Engaging with the South as a structural condition,[10] it interrogates the epistemological grounds that render some bodies unintelligible.[11] This approach demands a polyphonic reading attuned to dissonance and contradiction, understanding space, power, and knowledge as mutually constitutive and continually negotiated.[12] It also enables a critical interrogation of the material, social, and symbolic infrastructures that produce uneven urban futures. By tracing these entanglements, it reveals the subtle mechanisms through which power and marginality are enacted in everyday urban life. Ultimately, it positions urban analysis as a method for revealing, resisting, and reconfiguring entrenched hierarchies in both theory and practice.

Grounded in these four frameworks, the practice module is organized around three interconnected components: the studio, the Urban Design Otherwise (UDO) and the Overseas Practice Engagement (OPE). Together, these elements position students as active participants in reframing urban knowledge, challenging dominant epistemologies and global hierarchies embedded in urban design education.

Studio and Making Workshops

The studio foregrounds both conceptual and practical engagement against the dominance of Eurocentrism by situating design research within contested urban territories. Through the co-development of Making Workshops, students are encouraged to engage directly with sites where the contradictions and conflicts of capitalism are revealed through embodied knowledge, affect, and reflexive associations. These workshops introduce design research as a creative and critical practice, asking students to observe, translate, and reframe lived experience into spatial narratives attentive to marginalised and often invisible conditions. One such example is *Re-reading the City: A Non-regulatory Narrative*, which invites students to represent their chosen site across multiple scales—

from the city and neighbourhood to the street, pavement, block, home, and room. Central to this approach are the concepts of rupture,[13] and holding.[14] *Rupture* is understood both as a disruption - emerging through conflict, displacement, disaster, or socio-political upheaval that fragments stories, memories, and identities-, and as a site of possibility, where dominant narratives and consolidated power over place-making can be unsettled, re-articulated, and reclaimed. *Holding* captures the ways urban populations are repeatedly settled, unsettled, and re-settled through speculative renewal projects, border regimes and austerity politics. Together, these processes produce spaces of suspension in which people are simultaneously mobile and immobilised, visible and opaque, included and excluded in precarious geographies of camps, underpasses, bridges, ring-road edges, and urban voids.

Urban Design Otherwise (UDO)

Urban Design Otherwise extends this critical orientation by foregrounding intersectional, decolonial, feminist, and critical practices beyond the studio, through partnership with communities, collectives, BUDD alumni and spatial design practices in London. The 2025 and 2026 editions refuse the neutrality of design expertise and reposition the designer as an engaged, accountable actor within ongoing urban struggles. Students are thus introduced with design not as a corrective tool or managerial solution, but as a process that stays with conflict, uncertainty, and contradiction. While UDO 2026 is under development on the theme of *Designer as Activist*, the UDO 2025, entitled 'In-out[side]: Rethinking Urban Networks for Transformative Actions in Pelican House', foregrounded relational networks, in/outside dynamics, and collective knowledge-building in order to challenge the spatial and institutional boundaries through which planning authority is produced and maintained. Engaging directly with actors from the Pelican House collective, in London, and in collaboration with BUDD alumni working within the Unit 38 design collective, the workshop was developed through on-site engagement and a guided walking tour around Brick Lane. In this way, the workshop enacted its In-out[side] theme by moving methodologically and spatially between the inner spaces of Pelican House and the surrounding neighbourhood. The workshop examined Pelican House as both an internal institutional space and part of a wider urban field, challenging assumptions of neutrality by analysing how authority, social relations, and spatial arrangements are produced and negotiated. Through on-site exploration, collective mapping, walking, and role-play, it situated the building within broader contested geographies, making visible the dynamics of power, exclusion, resistance, and negotiation shaping Bethnal Green.

Overseas Practice Engagement (OPE)

These commitments – to pluralizing, reframing, decentering, decolonizing – are further developed through our OPE, where students work closely with housing occupation movements in São Paulo as sites in which orientation is materially, affectively, and epistemically reconfigured, negotiated, and resisted, particularly through the leadership and everyday practices of Black women within these movements. Through this engagement, students are invited to co-research the spectrum of urban transformations and the political subjects shaping selected urban spaces, and co-develop design research frameworks, strategies, and interventions situated within existing governance structures and processes. In this regard, orientation makes visible how spatial pathways are opened for some and closed for others, how racialized bodies are differentially directed, and how institutional boundaries are actively negotiated or resisted. It also demands a corresponding reorientation of readings and interpretation and insists on what Said describes as a polyphonic mode of reading and learning: one attuned to dissonance, partiality, and contradiction. In this sense orientation becomes polyphony by

rendering both design and institution as occupation where acts of collective dwelling, making and resisting generate their own spatial and aesthetic languages and materials to engage with.

CONCLUSION

The Spatial Design Practices' feminist lexicon is produced for, through, and within a studio that advances an embodied pedagogy of care, collectivism, and resistance. It operates through four interwoven frameworks of *Dislocating/Decentering, Pluralizing, Decolonizing, and Reorienting*, and conceptual practices of *rupture*, *holding*, *belonging*, *polyphony*, and *being out of place*, hence remain deliberately unfinished and open to contestation. This lexicon resists the temptation to stabilise pedagogy into another toolkit or method to be instrumentalised by top-down, mainstream design practices. Instead, it consistently positions spatial practice as an ongoing struggle—one that must continually entangle with its own positionalities, limits, and complicities, even within institutional structures. Drawing inspiration from tactical, informal, and incremental practices in the Global South, the lexicon deliberately unsettles the dominance of large-scale, finance-led, and growth-oriented models of contemporary urbanism.[15] It insists on a shared enquiry into urban development as a racialised, embodied, and contested process, in which vulnerability, marginality, and otherness become political conditions to be engaged with. In this sense, the lexicon stands against reproducing the master's tools and instead attends to the afterlives of colonialism and slavery, recognising how these forces continue to structure urban space, institutional practices, and regimes of expertise. The embodied feminist lexicon thus is a refusal. It refuses extractive modes of knowledge production, disembodied expertise, and pedagogies that claim neutrality while reproducing inequality. At the same time, it reclaims urban design education as a space for ethical, political, and imaginative labour—where students are invited to remain accountable to the lives, histories, and struggles that make urban futures possible. By staying attentive to the messiness of urban life, the lexicon gestures toward more just, liveable, and solidaristic urban worlds where urban spaces are collectively and continually made, remade and unmade.

NOTES

[1] Giovanna Astolfo, Giorgio Talocci, and Camilo Boano. “A Six-Fold Mandate for an Engaged Urban Design-Research Education.” *Urban Pamphleteer: Global Education for Urban Futures* 5 (2015): 43–45.
[2] Jeremy Till, *Architecture Depends* (Cambridge, MA: MIT Press, 2013); Camillo Boano and Rocco Luigi Peragine, “A Pedagogy of Uselessness: Challenging Solutionism and Utility in the Anthropocene through Architectural Pedagogy,” *The Journal of Architecture*, 2024.
[3] Harriet Harriss, Ashraf M. Salama, and Anne Gonzalez Lara, eds., *The Routledge Companion to Architectural Pedagogies of the Global South* (London: Routledge, 2022).
[4] Jane Rendell, *Art and Architecture: A Place Between* (London: I.B. Tauris, 2006); Nishat Awan, Tatjana Schneider, and Jeremy Till, *Spatial Agency: Other Ways of Doing Architecture* (London: Routledge, 2011); Arturo Escobar, *Designs for the Pluriverse* (Durham, NC: Duke University Press, 2018); L. Natarajan and Michael Short, eds., *Engaged Urban Pedagogy: Participatory Practices in Planning and Placemaking* (London: UCL Press, 2023); Catalina Ortiz, Penny Travlou, Marina Siqueira, and Giulia Testori, “Decolonising Urban Knowledge(s): An Ordinary Imperative in Extraordinary Times,” *City* 29, nos. 3–4 (2025): 485–501.
[5] Bell Hooks. “Choosing the Margin as a Space of Radical Openness.” *Framework: The Journal of Cinema and Media* 36 (1989): 15–23. http://www.jstor.org/stable/44111660.
[6] María Lugones, “Playfulness, ‘World’-Travelling, and Loving Perception,” *Hypatia* 2, no. 2 (1987): 3–19, https://doi.org/10.1111/j.1527-2001.1987.tb01062.x.
[7] Audre Lorde, “The Master’s Tools Will Never Dismantle the Master’s House,” in *Sister Outsider: Essays and Speeches* (Berkeley, CA: Crossing Press, 1984), 110–113.
[8] Sara Ahmed, *Queer Phenomenology: Orientations, Objects, Others* (Durham, NC: Duke University Press, 2006).
[9] Achille Mbembe, *Critique of Black Reason*, trans. Laurent Dubois (Durham, NC: Duke University Press, 2017).
[10] Ananya Roy, *At the Limits of Urban Theory: Racial Banishment in the Contemporary City*, audio recording (London School of Economics, 2018), https://www.mixcloud.com/LSE.
[11] Huda Tayob, “Race, Space and Architecture,” in *The Routledge Companion to Architectural Pedagogies of the Global South*, ed. Harriet Harriss, Ashraf M. Salama, and Anne Gonzalez Lara (London: Routledge, 2022), 200–212.
[12] Edward W. Said, *Culture and Imperialism* (London: Chatto & Windus, 1993).
[13] Sana Murrani, *Rupturing Architecture: Spatial Practices of Refuge in Response to War and Violence in Iraq, 2003–2023* (London: Routledge, 2024).
[14] Mastromarino Stefano and Camilo Boano, “Inhabiting through Interstitial Opacity: Protective Negotiations of Suspended Existence across Paris’ Liminalities,” *Transactions of the Institute of British Geographers*, 2024.
[15] Neil Brenner and Christian Schmid, “Towards a New Epistemology of the Urban?” *City* 19, nos. 2–3 (2015): 151–182.

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A HOLISTIC APPROACH TO TEACHING DESIGN AND ARCHITECTURE: THE INTEGRATED DESIGN AND CONSTRUCTION STUDIO OF THE BUILDING BEAUTY PROGRAM

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INTRODUCTION

Architectural design education has recently been part of the 'outward turn' of academia, with an increased emphasis on real-world design problems, participatory design, and design-build projects. The Building Beauty architectural program integrates these approaches into a *holistic* design approach that focusses on fostering a sense of place and adapting to the needs of building occupants.

The one-year program was founded in 2017 by former students of architect and theoretician Christopher Alexander (1936–2022), together with new partners. It builds on and continues Alexander's integrative teaching approach based on his theory of "wholeness" and environments that have "life." This approach combines theoretical study with introductory and advanced design studios concentrating on real-world projects and involving students in real construction and making.

This paper discusses Alexander's teaching methods and focusses on the final studio assignment of the Building Beauty program: the Integrated Design and Construction Project, a community-based participatory design-build project that engages local partners. Since the program shifted to an online format in 2019, students have carried out this project in their local communities worldwide. Two examples are described: a community gathering place in Detroit, MI, and a rooftop community garden in Malmö, Sweden.

Lessons for the future of built environment pedagogy are then formulated based on interviews with students and instructors, and on contextualizing the Building Beauty program within the growing number of community-engaged design-build studios.

THE BUILDING BEAUTY PROGRAM: TEACHING LIFE AND WHOLENESS

There are certain human situations, spaces, even objects, that seem to have a sense of "life:" a well-crafted bowl can feel alive, as can a door, a room, or a street. This phenomenon was at the heart of the research, practice, and teaching of Christopher Alexander.[1] He claimed that we can judge when something has more life or less life,[2] and that the perception of this quality is largely shared.[3] This quality is detected through *feeling*, yet it is real and measurable.[4] It arises from what he described as

the "wholeness" of the situation, or the coherence of interrelated spatial relationships.[5] He aimed to describe this quality and to find processes for realizing it in today's built environment.[6]

Alexander's legacy is sustained in the architecture program that he co-founded in 2017, Building Beauty.[7] This program proposes a pedagogical framework for building environments with life and wholeness. It is based on the Building Process area of concentration at UC Berkeley, especially the Building Process introductory studio, which was taught by Christopher Alexander and his colleague Hajo Neis.[8] The studio integrated design and construction in a continuous adaptation between people, buildings, and places that historically has given rise to "living" architecture.[9] The process was phenomenological,[10] privileging direct experience by designing through on-site full-scale mockups,[11] an approach that was adopted by Building Beauty. According to Alexander, judgments of how a space makes us *feel* – which is how we detect wholeness – can only be made in three dimensions, in the real world.[12]

Building Beauty is a one-year program open to anyone with a completed or in-progress undergraduate degree. It is based at the Sant'Anna Institute in Sorrento, Italy, and enrolls seven to twelve students annually. Since the covid-19 pandemic, instruction has primarily been online, but has continued to emphasize physical making.

The two-semester curriculum has a design and construction studio as a core in the fall and spring semester, and a theory seminar in which the students read all four volumes of *The Nature of Order*. Additionally, in the fall semester, students take a reading seminar titled Self and Wholeness. In the spring semester, there is a Construction Experience course in which students design and build a piece of furniture, and a course about Color and Inner Light.

THE BUILDING BEAUTY DESIGN STUDIO

The method taught in the design studio brings together the needs of the site and the needs of the users in an integrated design and construction process, the elements of which are shown in the diagram below.[13] The curriculum teaches this method starting from the small scale – a small Personal Object, a Room Design, and a House for Oneself – to the larger scale: the Integrated Design and Construction Project, at an urban scale with a community.

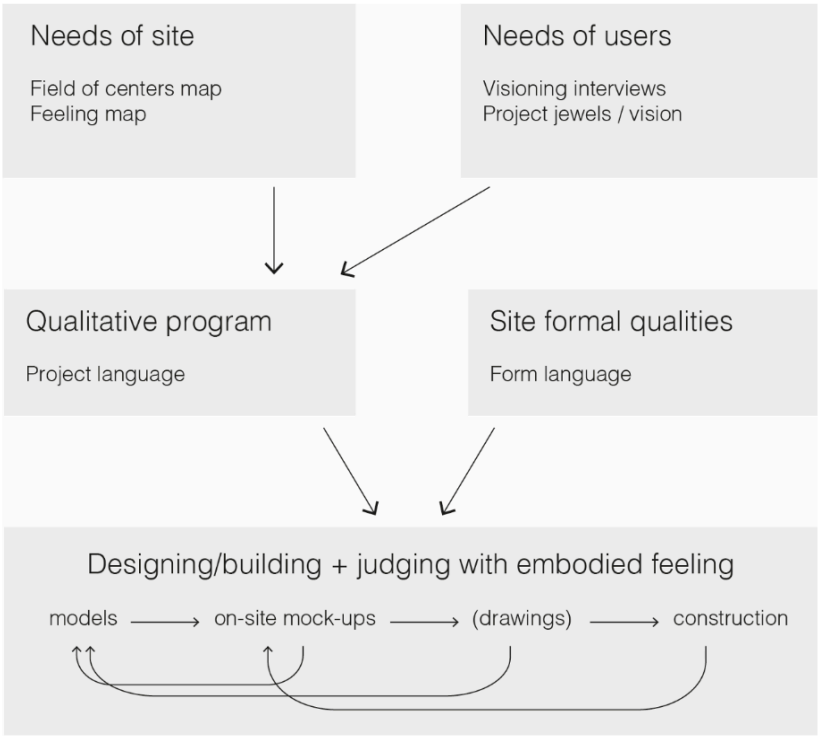


Figure 1. Diagram of the design process taught in the Building Beauty studio.

The aim of the Personal Object is to hand-craft a small object that has "feeling," and that can touch the student and others "on a deep emotional level."[14] Students learn to judge with "deep feeling," which is different from idiosyncratic aesthetic taste,[15] to detect life and wholeness in the environment and how the small object might increase these qualities.[16] Two examples are shown below: a spice box by Indian architectural student Aarti Dhingra for her kitchen in Germany (left), and a tile by Detroit-based children book author and former tech and advertising art director Jack Cheng (right).[17]



Figure 2. Personal Objects by students Aarti Dhingra (left) and Jack Cheng (right).

For the Room Design, students build a full-scale cardboard mock-up of a piece of furniture or built-in that increases the life and wholeness of a room.[18] The project introduces a method for analyzing and drawing the needs of the site, understood as the web of spatial relationships that forms the wholeness of a space: the 'field of centers drawing.' Alexander defines 'centers' as the "coherent entities which form the whole," such as a house, a kitchen, a stove, or a pond, as well as any other coherent

perceivable entities, such as the space under a tree, defined by its foliage.[19] Field of centers mapping is the most important part of site analysis in this method, because if the intention is to impact the feeling, wholeness, and life of a place, then these aspects must first be visualized. Based on the field of centers drawing, students design an intervention, using mock-ups to judge the effect on the feeling and wholeness of the space.

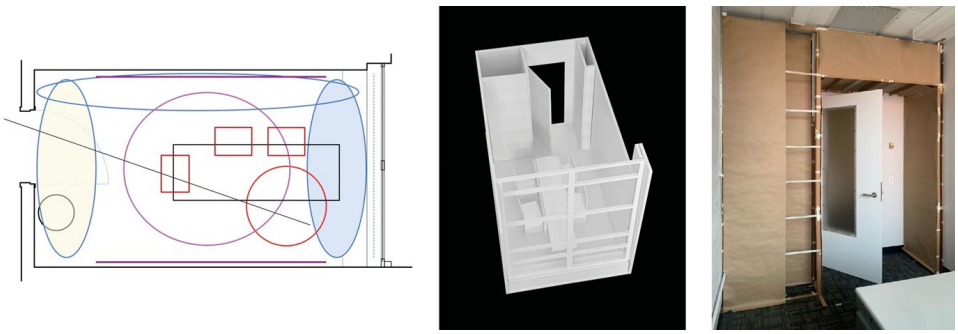


Figure 3. Room Design by Isabel Potworowski. From left to right: field of centers analysis, 1:10 model, and full-scale mock-up using cardboard and craft paper.[20]

The third assignment of the fall semester design studio is the House for Oneself. The aim is to design a house with feeling and a deep sense of belonging.[21] The first step is to envision elements and spaces that evoke this feeling. Through a visioning meditation, students imaginatively walk through and spend a few days in their ideal home, a place with life and wholeness. Capturing aspects from this visioning exercise, they identify five to seven spaces or elements, describing their sensory and physical qualities.[22] These elements are called 'project jewels;' they are the most important 'centers' that make the wholeness of the project. Each jewel is given an evocative title, a short description, and a sketch. The titles can use poetic language and evoke the linguistic imagination.[23] They should convey the intended feeling and atmosphere, as that is what will be transferred to the final design. For example, Jack's project jewels were titled:

Monastic Courtyard
Light-filled Workshop
Waking-from Nap View
Stage-like Open Kitchen
Radiant Kitchen Hearth
Cold Air, Hot Sauna
Sleeping in a Cave [24]

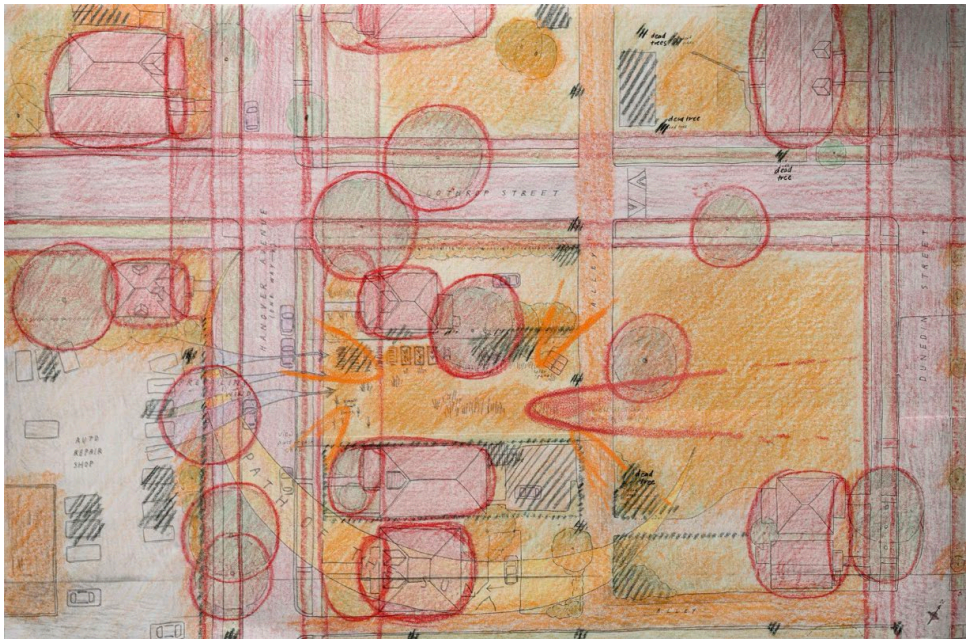


Figure 4. Field of centers drawing by Jack Cheng of his neighborhood in Detroit. Red shows strong centers, orange shows latent centers, and black shows weak centers and areas that need repair.

Then, students select a site that needs "healing," and carry out a field of centers analysis, as they did for the Room Design.[25] They identify strong centers with a positive feeling and weaker, more negative centers.

The site design is based on the principle "Site Repair," which is Pattern 104 in Alexander's book *A Pattern Language.*[26] The principle is to preserve the best parts of the site by building on the worst parts. Using on-site stake-outs (placing sticks or poles connected by surveyor's tape), students identify the areas on the site that feel the best or most comfortable. This area is measured and demarcated in the physical model. It is reserved for the garden, which is placed first, before the house. Only afterwards are volume options tested for the house. Afterwards, the entrance and entry sequence are placed, then the most important room, and subsequently the other 'jewels.' The size and placement of each of these elements is determined through stake-outs and models to judge experientially; drawings are not required. The placing of elements follows this overall sequence, fixing the placement of one 'jewel' at a time, as opposed to making iterations of floor plans. According to Alexander, such "sequences of unfolding" are what generate places with life and wholeness.[27]

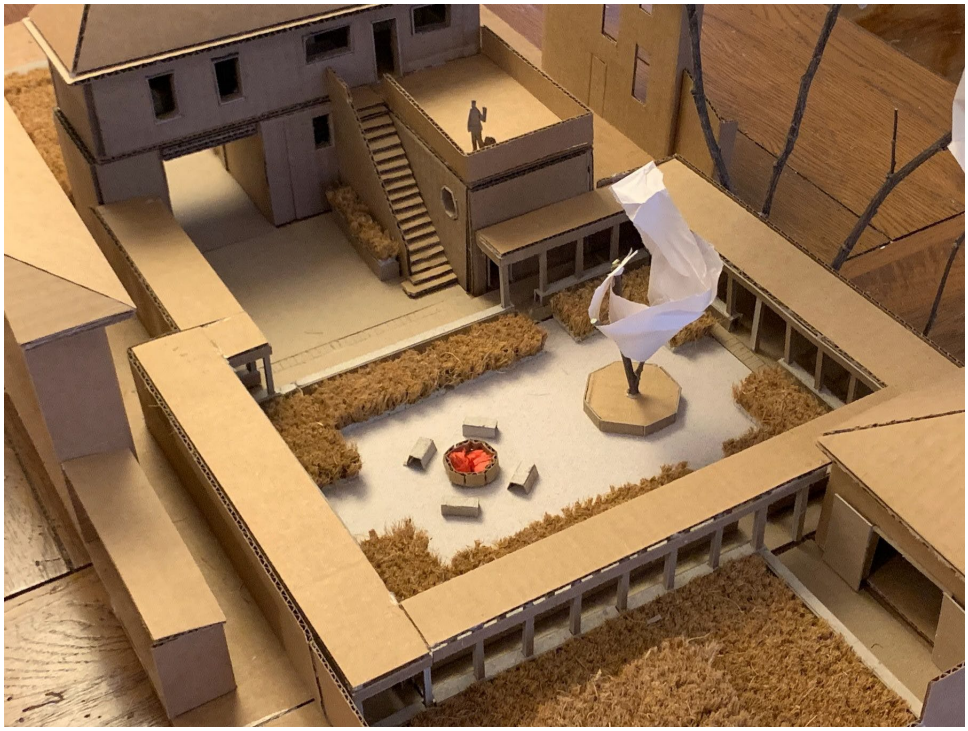


Figure 5. Final house design by Jack Cheng, 1:50 model.

Integrated Design and Construction Project

The spring semester Integrated Design and Construction Project is a culmination of these methods, implemented at a larger scale: a design-build project of a communal space. Initially, it was carried out at the Sant'Anna Institute in Sorrento, Italy,[28] but since 2020, it has been taught online, with students working in their local communities. The two projects described below are a front lawn community corner in Detroit by Jack Cheng (2023) and a rooftop community garden in Malmö by Tomaž Žlender (2021-2022). Other projects have included a community park in Peru, a communal gathering place on a farm in Slovenia, a garden for a Montessori nursery in Belgium, and a public space for a u-pick blueberry farm in Iowa.

Community Corner by Jack Cheng[29]

Working in his neighborhood in Detroit, Jack began by making a field of centers analysis. Through additional site analysis drawings and a 1:200 site model, he showed the divisions between the vehicular and pedestrian, and between the public and private realms that seemed to weaken the wholeness of the neighborhood.

Next, Jack carried out guided visioning meditations in individual interviews with a dozen of his neighbors, asking them to close their eyes and imaginatively walk through their "dream neighborhood" and describe what they see, hear, and feel.[30]

Based on site analysis and visioning interviews, he formulated a qualitative program or 'Project Language,' a series of interconnected spatial geometries and qualities called 'patterns,' similar to the 'project jewels.' [31] He described 24 patterns, with larger-scale patterns, such as "urban woodland" and "unique old houses," connected to smaller-scale ones, such as "front yard places," "charming cluster of shops," and "connection to water," together forming a web of spatial relationships that describes the wholeness of the project.[32]

When selecting the location for his project, Jack decided to build on his front yard, following Pattern 8 “front yard place” from his Project Language. Finding that there were too few design constraints, he returned to the visioning interviews, this time at the scale of his front lawn. He interviewed his partner, and he had his partner interview him. The result was a second, ‘mini’ Project Language, which elaborated his vision for the front yard in particular:

Sensuous entrance transition
Welcoming sidewalk gateway
Deep, covered sitting porch
Multi-purpose outdoor room
Colorful quilt of native plants
Community corner[33]

The role that the Project Language fulfills is similar to that of the design ‘concept,’ which is to guide design decisions in the design process, but instead of doing so by means of an abstract or intellectual concept, it specifies the feeling and experience that the design is intended to evoke.[34] It is combined with a Form Language, which is a context-derived geometric and material vocabulary.[35] Jack visited nearby neighborhoods and green spaces, identifying character-defining qualities and formal principles, such as low stone walls and red brick pavers and steps.

The Project Language and Form Language guided an iterative design and construction process that oscillated between scaled models, on-site stake-outs and mock-ups. Design options in the 1:200 model were tested on site and adjusted so that they felt right. For instance, through stake-outs, he found that the outdoor room had to be further from the sidewalk and smaller than in the 1:200 model, to achieve the desired level of intimacy. He followed a similar process with a 1:50 model to define planted areas and the outdoor room, testing and adjusting stake-outs, based on which the model was adjusted.



Figure 6. Front lawn design by Jack Cheng before (left) and after (right) the stake-out process, shown in a 1:200 model.



Figure 7. Front lawn design by Jack Cheng before (left) and after (right) the stake-out process, shown in a 1:50 model.

When deciding where to start building, Jack chose the community corner at the street intersection, because it had the biggest impact on the neighborhood. His house sits at a bend in the boulevard, and the corner is a natural stopping and resting place for passers-by. While the project is still on-going, the overall process, especially the community interviews, sparked initiatives among other community members, including game nights and preparations for puppet shows in the park.



Figure 8. Community corner model and in-progress construction by Jack Cheng.

Rooftop garden by Tomaž Žlender [36]

Among the larger Integrated Design and Construction Projects is the community rooftop garden in the western harbor (Västra hamnen) area of Malmö, Sweden, by computer programmer Tomaž Žlender.[37] The project emerged from bringing together the needs of the community and of the site. His partner was part of a community gardening group who needed to move their garden the following year. The makerspace that Tomaž contacted for help with the building process was located under a slipway in the former shipyard. He learned that already three groups of people had previously suggested making a rooftop garden on top of this makerspace, indicating a community need and a potential of the site.

Through site analysis and centers mapping, Tomaž considered how a roof garden might impact the surrounding neighborhood and how it in turn might be affected by it. Considering the site holistically, he made a design for the entire roof, the spatial principles of which were later realized at a smaller scale on a fragment of the roof.

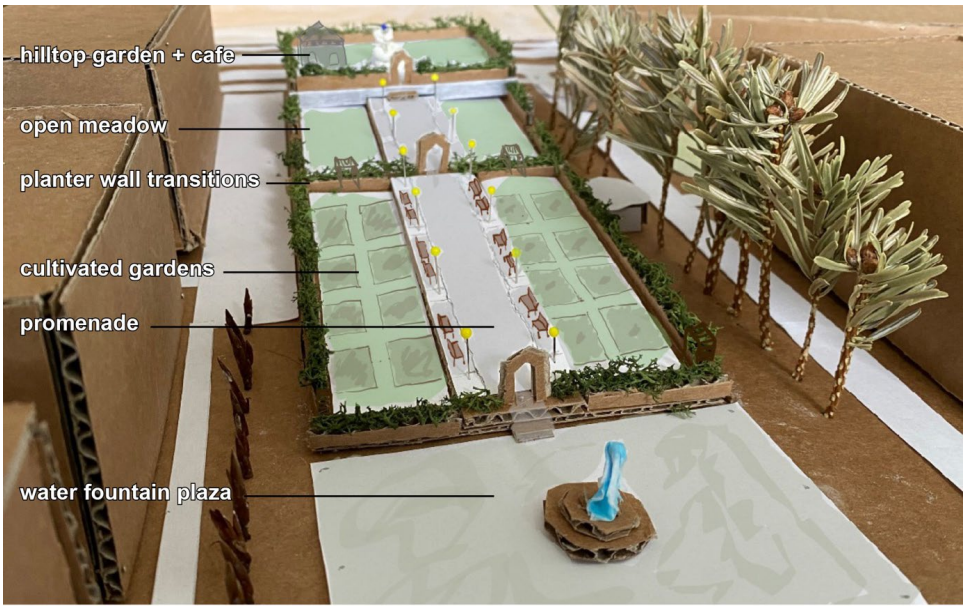


Figure 9. Rooftop garden design by Tomaž Žlender, 1:200 model.

A few months after completing the Building Beauty program, Tomaž secured a contract with the city. The planter boxes arrived, and he tested various configurations on site, judging what arrangements felt best – similar to the stake-out process.

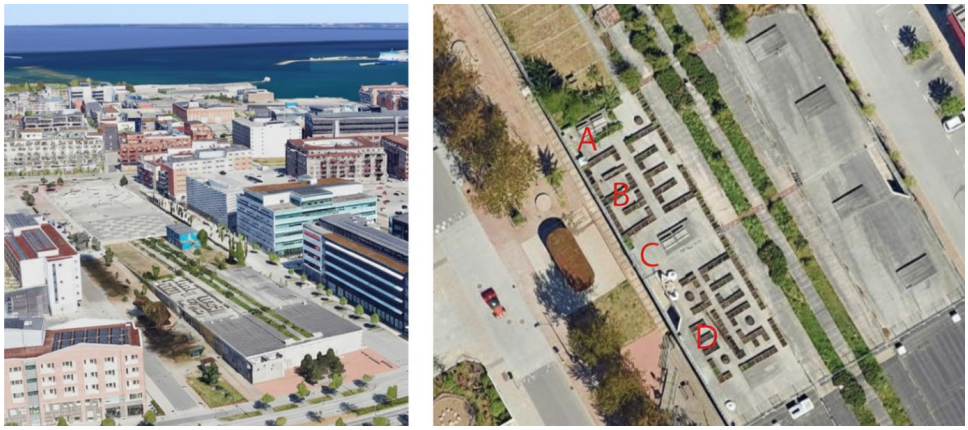


Figure 10. Realized rooftop garden by Tomaž Žlender (Google maps images, annotated by author).

He adapted spatial principles from the larger roof design, especially boundaries and transitions. In the plan above, areas A and C are transitional communal spaces, leading to areas B and D with individual planter boxes. To enter area A, one passes through a threshold of bushes; at the end of this axis is a round planter, then the path changes direction to enter area B. Area A has two picnic tables, shielded with planter boxes with fruit bushes. There is a similar transition area in area C. A line of planter boxes strengthens the border between the garden and the central spine of the slipway.

The garden has been a success, and has changed Tomaž's relation to his community. It is now in its fourth growing season. There is a waiting list for joining it, workshops take place throughout the year, and schools bring students on tours. Prior to this project, Tomaž was new to Sweden, and did not believe that he could influence public space. The project has given him a sense of belonging in the city.

LESSONS FOR ARCHITECTURAL PEDAGOGY

The aims of the Building Beauty program are to teach students about life, wholeness, and the design and building processes from which these qualities arise, applying them in the Integrated Design and Construction Project. For the present study, semi-structured interviews were carried out with students and instructors.[38] They described the lessons learned from the program as well as the challenges.

Challenges	Lessons
Online teaching environment (2) Logistical challenges - City administrative challenges (3) - Client challenges (2) Scale of urban project (2) Contacting community for interviews (2) Physical aspects: - Stake-outs (2) - Physical models (1) - Building and craft (1) Time commitment (3)	Judging work on site, not confusing it with graphic representations of the work (2) Adapt to context, rather than applying precedents that do not belong (2) Always consider the whole (field of centers) (3) Students can make a difference where they live (2) Importance of process and unfolding sequence for creating wholeness (2) Learning about feeling and wholeness (theoretical underpinnings), especially through *Nature of Order* (3) A path and method to follow (2)

Table 1. Challenges and Lessons. Numbers indicate the number of people who discussed the topic.

Among the challenges are the online teaching environment, as well as the physical aspects of making; many students have no architectural background and are building models for the first time. The time commitment is also a challenge, as most students take this course in addition to their full-time work or study.

The lessons that students take from the program include an awareness of the wholeness of their environment and a method for strengthening it, which includes mapping fields of centers, design processes and unfolding sequences, and representation methods. They also learned to apply these methods to the places where they live.

These lessons suggest the value of the Integrated Design and Construction Project and the Building Beauty program for architectural pedagogy. Many design-build programs already exist, such as Rural Studio at Auburn University in Alabama, Design Build Bluff at the University of Utah, the Community Design Outreach Course and the University of San Francisco, and the Yestermorrow Design/Build School in Vermont. Often, the aim of such programs is to connect design with construction, communities, social issues, and environmental concerns.[39] Building Beauty is much more modest in scale, and its emphasis is different; social and environmental concerns are present, but the primary aim is to build environments with life, wholeness, and 'deep feeling,' which are aspects of how Alexander conceptualized 'beauty.'[40] The lessons that Building Beauty offers for architectural pedagogy are methods for building these qualities.

NOTES

[1] Christopher Alexander, “The Phenomenon of Life,” in *The Nature of Order: An Essay on the Art of Building and the Nature of the Universe* (New York: Oxford University Press), 1:27–62.
[2] Alexander, “Differing degrees of life in our everyday surroundings,” in *The Nature of Order,* 1:63–71.
[3] Alexander, *Differing degrees of life*,1:71.
[4] Alexander, *Differing degrees of life*, 1:32–49, 64. See also Alexander, “Deep Feeling,” in *The Nature of Order,* 2:370–373.
[5] Alexander, “Wholeness and the Theory of Centers,” in *The Nature of Order,* book 1, chap.3. See esp. p.96.
[6] Regarding associated processes, see Alexander, *The Process of Creating Life,* book 2 of *The Nature of Order.* More specific processes for diverse scales and typologies of the built environment are given in book 3, *A Vision of a Living World.*
[7] Building Beauty, accessed January 28, 2026, https://www.buildingbeauty.org/
[8] Regarding the relation between Building Beauty and the Building Process Area of Emphasis at UC Berkeley, see Susan Ingham and Or Ettlinger, “Teaching Wholeness in Architecture Education: Advancing Christopher Alexander’s Teaching Legacy Through the Building Beauty Program,” *Journal of Architecture and Urbanism* 47, no.2 (July 2023): 125–134. Regarding the Building Process Area and its aims, see Hajo Neis, “The Building Process: A New Direction In Architectural Education,” ACSA European Conference Proceedings (Lisbon, 1995): 271–278. Susan Ingham also described Alexander’s studio at UC Berkeley in her interview for the present paper.
[9] Neis, *The Building Process*, 271.
[10] For a discussion of Christopher Alexander’s notion of wholeness in the context of phenomenology of place, see David Seamon, “Ways of Understanding Wholeness: Place, Christopher Alexander, and Synergistic Relationality,” *World Futures: The Journal of New Paradigm Research* (March 2024), accessed January 28, 2026, https://doi.org/10.1080/02604027.2024.2330288
[11] Neis, *The Building Process*, 276–277.
[12] Alexander, *The Nature of Order*, 2:234–241, 370–371.
[13] This diagram is based on documentation of student work on the Building Beauty website, Ingham and Ettlinger’s article “Teaching Wholeness in Architectural Education,” and interviews with instructors carried out as part of the present study.
[14] Assignment outline for the Personal Object project. About this project, see also Ingham and Ettlinger, 129. In the first two years of the Building Beauty program (2017-2018), this first assignment was focussed on making vessels, tiles, and ornamental carpets. See Yodan Rofé, Sergio Porta, Susan Ingham, Christopher R. Andrews, Or Ettlinger, Paolo Robazza, and Maggie Moore Alexander, “Building Beauty: A New Program Teaching Students to Help Heal the World,” *in Green Buildings and Renewable Energy: Med Green Forum 2019 – Part of World Renewable Energy Congress and Network,* ed. Ali Sayigh (Cham: Springer, 2020), 616.
[15] Alexander, *The Nature of Order,* 1:300.
[16] On using “deep feeling” as a means of judgment, see chap.7 “The Personal Nature of Order” and chap.8 “The Mirror of the Self” in *The Nature of Order,* book 1.
[17] Jack Cheng, “Studio Project #1: Ornament,” accessed January 28, 2026, https://www.jackcheng.com/studio-project-1-ornament/. For further examples of student work, including the project by Aarti shown below, see “Student Work,” Building Beauty, accessed January 28, 2026, https://www.buildingbeauty.org/student-work.
[18] Assignment outline for the Room Design project.
[19] Alexander, *The Nature of Order,* 1:92–94.
[20] This project was completed by Isabel Potworowski in 2025. It was done for the Construction Experience course of Building Beauty, not the design studio, but the initial project stages (shown in the figure) are the same.
[21] Assignment outline for the House for Oneself. Regarding this project, see Rofé et al, “Building Beauty: A New Program Teaching Students to Help Heal the World,” 617. For an extensive explanation of the process, see student Jack Cheng’s documentation of his project on his personal website, “A House for Oneself, Part 1” and “A House for Oneself, Part 2,” accessed January 28, 2026, https://www.jackcheng.com/sunday/392-a-house-for-oneself-part-1/, https://www.jackcheng.com/sunday/393-a-house-for-oneself-part-2/.
[22] This meditation is a method for opening to or accessing one’s dreams, intuitions, desires, and deeply felt needs. On the topic of accessing such inner resources in design pedagogy, see also Andrew Levitt, *The Inner Studio: A Designer’s Guide to the Resources of the Psyche* (Cambridge, ON: Riverside Architectural Press, 2007), especially part two “The Creative Instinct” and part three “Inner Resources.” Levitt discusses these topics based on the psychology of Carl Jung.

[23] In some of his projects, Alexander begins by composing lists of such project jewels – which he calls a system of centers or patterns – so that they evoke the feeling and atmosphere of the project. For example, see Alexander, chap.13 "Patterns," in *The Nature of Order,* book 2, esp. 360–366. Others have also written of using poetic language in the architectural design process; see for example Klaske Havik, "Between the Lines: Poetic Imagination and Architecture that Moves Us" (paper presented at the 2022 Architecture Culture and Spirituality Forum symposium, Fallingwater, Bear Run, Pennsylvania, June 1-5, 2022), accessed January 28, 2026, https://acsforum.org/between-the-lines-poetic-imagination-and-architecture-that-moves-us/, Alberto Pérez-Gómez, chap.6 "The Linguistic Dimension of Architecture: Attunement and the Poetic Word" in *Attunement: Architectural Meaning after the Crisis of Modern Science* (Cambridge, Mass.: MIT Press, 2016), and Christopher Bardt, chap.3 "Words Matter" and chap.4 "Representing," in *Material and Mind* (Cambridge, Mass. and London: MIT Press, 2019).

[24] Jack Cheng, "A House for Oneself, Part 1."

[25] Assignment outline for the House for Oneself.

[26] Christopher Alexander, Sara Ishikawa, Murray Silverstein, Max Jacobson, Ingrid Fiksdahl-King, and Shlomo Angel, *A Pattern Language: Towns, Buildings, Construction* (New York: Oxford University Press, 1977), 508–512.

[27] On the importance of sequences for generating environments with life and wholeness, see Alexander, chap.11 "The Sequence of Unfolding," in *The Nature of Order,* book 2. Designing through sequences and testing through on-site stake-outs are scalable to larger projects. Alexander used them in his architectural practice, for instance for the Upham House in California and the Eishin campus in Japan. For a detailed description of the Upham House project process, see Appendix A in *The Nature of Order*, book 2. Regarding the Eishin Campus, see *The Nature of Order* book 3 and Christopher Alexander, Hajo Neis, and Maggie Moore Alexander, *Battle for the Life and Beauty of the Earth: A Struggle Between Two World-Systems* (New York: Oxford University Press, 2012).

[28] For descriptions of the Sant'Anna Institute projects, see Ingham and Ettlinger, 130–132, Rofé et al., 617–621, and the pages "2017-18 Learning Journal" and "2018-19 Building Project" in the section "Student Work" on the Building Beauty website. The project in Sorrento began with four months of site analysis – including collaborative centers analysis and "feeling mapping" – multiple stages of interviewing Sant'Anna Institute staff and students, then preparing a qualitative program (Project Pattern Language and Form Language) for the gardens of the institute. The built interventions, though modest – a long stone bench and integrated water fountain in 2017-2018 and a seating area with a pergola and stone bench in 2018-2019 – aimed to make the biggest impact on the feeling and wholeness of the garden with limited means. They were built using an adaptive, incremental approach to construction. A similar project structure was maintained when the program shifted to an online teaching format.

[29] The description of Jack's project is based on his interview with Isabel Potworowski for the present paper (October 20, 2025, online) and on the extensive documentation on his personal blog: "Studio Project #4: Building in the Community, Part 1," accessed January 28, 2026, https://www.jackcheng.com/studio-project-4-building-in-the-community/ and "Studio Project #4: Building in the Community, Part 2," accessed January 28, 2026, https://www.jackcheng.com/studio-project-4-building-in-the-community-part-2/.

[30] Jack Cheng, "Studio Project #4: Building in the Community, Part 1."

[31] A Project Language, also called a Project Pattern Language, is a project-specific network of "patterns," where each pattern presents a design intention or solution as a field of relationships between patterns at larger and smaller scales. See Alexander, *A Pattern Language,* xiii. Jack self-published this project language as a zine and distributed it to his neighbours.

[32] See the complete list of patterns on Jack's website, "Studio Project #4: Building in the Community, Part 1."

[33] Jack Cheng, "Studio Project #4: Building in the Community, Part 1."

[34] Susan Ingham, interviewed by Isabel Potworowski (October 30, 2025, online). See also Alexander, *The Nature of Order,* 1:50, where he explains that objects that feel "alive" are seldom based on "concepts."

[35] For a description of the Project Pattern Language vs Form Language and examples of the two, see the "2017-2018 Learning Journal" on the Building Beauty website. See also Nikos Salingaros, part 1 "Pattern Language vs Form Language," in *A Theory of Architecture* (Portland: Sustasis Foundation, 2013).

[36] Tomaž Žlender, interviewed by Isabel Potworowski (November 5, 2025, online).

[37] For images of the garden, see "Student Work," Building Beauty, accessed January 28, 2026, https://www.buildingbeauty.org/student-work.

[38] Six people were interviewed by Isabel Potworowski: one student (Tomaž Žlender), three students who later became instructors (Jack Cheng, Saman Moein, and Julian Lang), and two instructors and founding members of Building Beauty (Susan Ingham and Maggie Moore Alexander). Interviews were carried out over Microsoft Teams

between September and November 2025. The interviews were transcribed, sent to the interviewees for editing, then thematically coded.

[39] William Carpenter and Dan Hoffman, *Learning by Building: Design and Construction in Architectural Education* (New York: Van Nostrand Reinhold, 1997), x–xi, 2–7; Ashraf Salama and Nicholas Wilkinson, *Design Studio Pedagogy: Horizons for the Future* (Gateshead: Urban International Press, 2007), 249.

[40] For a history and description of Alexander's writings on beauty, see Richard P. Gabriel and Jenny Quillien, "A Search for Beauty/A Struggle with Complexity: Christopher Alexander," *Urban Science* 3, no.2 (June 2019), accessed January 28, 2026, https://doi.org/10.3390/urbansci3020064.

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THEORY MEETS TERRAIN: RECONTEXTUALIZING ARCHITECTURAL DESIGN STUDIO THROUGH "SITUATED FLIPPED LEARNING (SFL)"

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INTRODUCTION - RECONTEXTUALIZING STUDIO PEDAGOGY: BETWEEN DIGITAL MEDIATION AND SITUATED EXPERIENCE

Architectural design studios have long been positioned pedagogically at the center of learning in situ and direct spatial experience. However, the increasing integration of digital tools, simulations, and online platforms into the design process in recent years has begun to reconfigure this pedagogical ground. While studio pedagogy is enriched by the opportunities offered by digitalization such as multi-layered representation, data-driven analysis, and remote collaboration; it simultaneously risks distancing itself from site-based modes of learning that cultivate spatial intuition, material awareness, and embodied engagement. This situation unsettles the traditional divide between the analytical and experiential components of design education, prompting us to reconsider how conceptual thinking can be meaningfully intertwined with sensory, embodied encounters in the studio process. Although digitalization enhances students' capacity to model complex environmental systems, it often relegates sensitivity to the cultural, ecological, and social context of place to a secondary position. This paradox calls for a restructuring of the studio, where digital and analog tools operate not merely as instruments of representation or analysis, but as pedagogical bridges that deepen on-site experience and enhance spatial awareness. Accordingly, the central task for architectural education is not simply to close the gap between digitalization and site experience, but to treat this gap as a productive space of negotiation, a pedagogical challenge that can be reframed to generate new forms of learning. This study proposes the "Situated Flipped Learning (SFL)" model to reconcile and reposition these two approaches within the context of the design studio.

Architectural education requires architects to understand the energy transition, how cities grow and develop, and how restlessly self-organize to exceed the plans and regulations imposed on them. This scale of investigation can be the preparatory work for a studio or become the design challenge itself, but in both cases, it will involve the metabolism of the city addressed in design studios.[1]

Contemporary architectural education operates within a shifting pedagogical terrain in which digital tools increasingly redefine the boundaries of studio learning. While virtual platforms and asynchronous content expand[2] access to knowledge and diversify representational instruments, they also risk dislocating design thinking from the bodily and socio-spatial contexts in which architecture is produced. As Kiel Moe argues,[3] within contemporary architectural culture the model increasingly operates not merely as a representational device but almost as an ontological construct in its own

right. Digital simulations and parametric systems risk abstracting projects from their material, ecological, and processual conditions; rather than mediating performative realities, models often substitute for them. In this shift from representation to substitution, performative reality is displaced by its digital proxy, obscuring architecture's embeddedness in environmental, energetic, and socio-spatial processes. Such abstraction intensifies the detachment of design thinking from bodily experience and lived context, calling for a critical re-situating not only of design tools but of learning itself.

In line with recent ecological perspectives on higher education[4], learning can no longer be conceived as a closed, linear, and pre-programmed sequence, but as an open, relational, and contextually embedded ecology. Knowledge emerges through the entangled interactions of bodies, spaces, technologies, temporalities, and communities. From this perspective, learning is not the execution of predefined pedagogical content but an emergent process of becoming situated within material and socio-spatial realities. SFL responds to this condition by repositioning the flipped classroom within architectural education through site-based engagement and temporal redistribution, grounding digital preparation in embodied and ecological contexts rather than allowing models to eclipse them.

SFL emerges in response to this gap, proposing a model that repositions the flipped classroom within architectural education through site-based engagement and a temporal redistribution of learning activities (Figure 1).

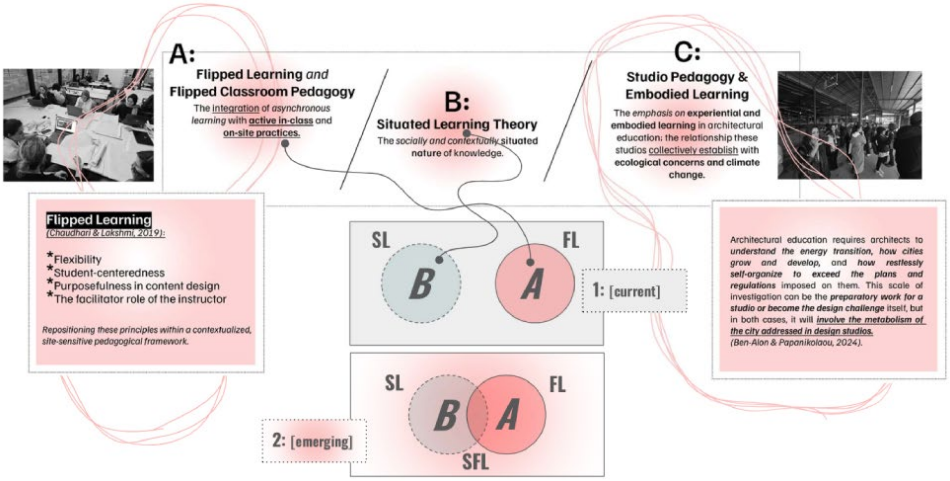


Figure 1. The diagram of the relationship between Situated Learning (SL), Flipped Learning (FL) and Situated Flipped Learning (SFL).

The aim of this approach is not to position digital or analog representational processes in opposition to site-based experience, but to interweave them within a continuous pedagogical cycle. Within the realities of the twenty-first century, rather than privileging one over the other or framing them in opposition, it proposes an integrative methodology that treats them within a productive dichotomy and co-presence. In SFL, theoretical inquiry and asynchronous learning materials such as curated readings,[5] atlases[6] that reproduce site knowledge, digital presentations, and seminars aim to prepare[7] students prior to fieldwork. Once in the field, the focus shifts from abstract analysis to embodied observation, mapping, and collective experimentation. Through this sequence, knowledge becomes both situated and reflective, allowing students to negotiate between mediated understanding and direct spatial encounter.

SFL integrates theory and fieldwork, transforming the design studio into a hybrid learning environment: a space where ecological, cultural, and material awareness are cultivated through active

participation. Findings from multi-year architectural design studio applications across Anatolian regions such as Harran (Şanlıurfa), Konya, Sinop, Eskişehir, and Gelibolu (Çanakkale) indicate that SFL enhances spatial awareness, critical thinking, and collaborative skills. This model encourages students to conceptualize context not merely as a backdrop, but as an active component of design reasoning and decision-making (Figure 2 and 3).

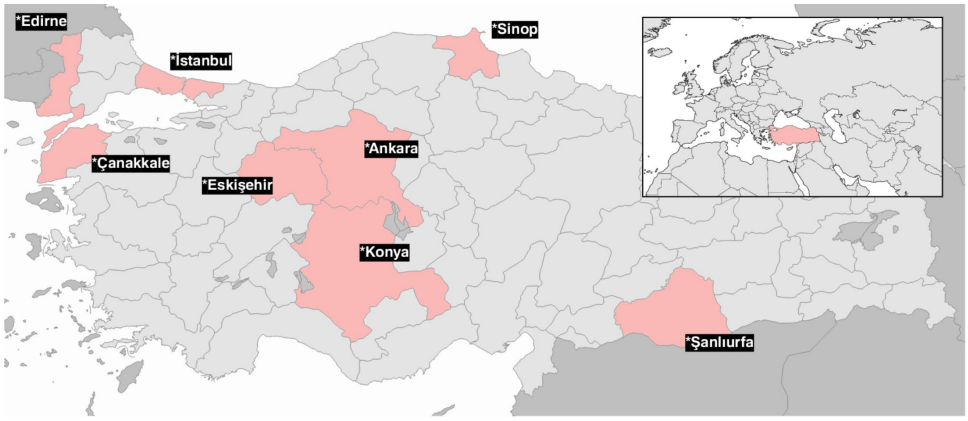


Figure 2. The focused regions for the design studios: İstanbul, Çanakkale, Eskişehir, Konya and Sinop (completed); Edirne and Ankara (currently working).

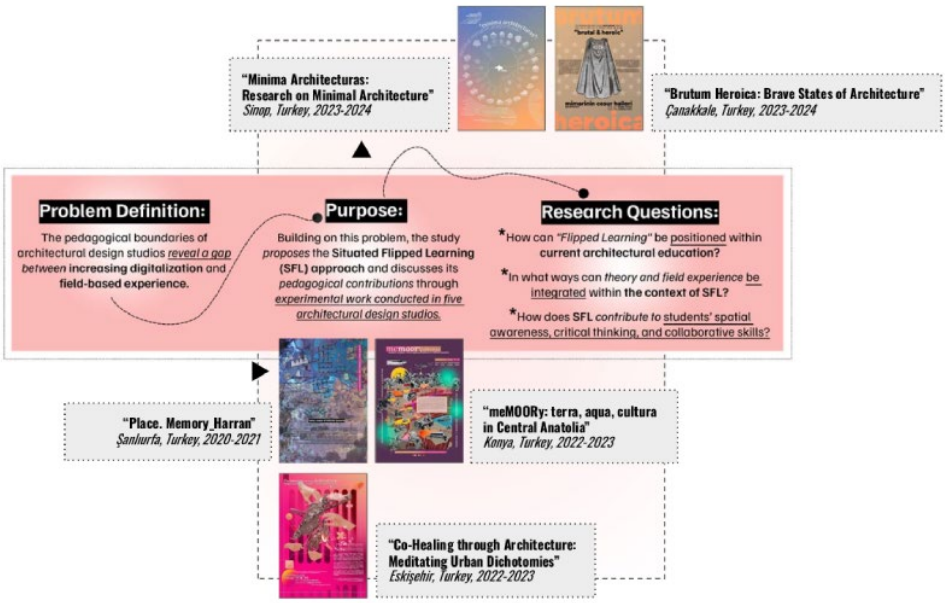


Figure 3. Problem, purpose and research questions through the multi-year architectural design studios.

Pedagogically, SFL redefines the role of the instructor from a transmitter of information to a facilitator who guides students through self-directed processes and exploration of inquiry, reflection, and discovery. By situating learning within lived environments while retaining the analytical affordances of digital platforms (such as digital models; photogrammetric data; satellite imagery visualization of ecological processes like vegetation cover, drought patterns, urban patterns, or urban heat islands; local news explorations; open data portals for environmental, demographic, and economic data available through platforms; social media data mining for reading local users' perceptions and spatial practices; online interviews or conversations through social network with local

people etc.), archival and discourse-based environments (e.g., map, plan, and aerial photograph archives; local media scanning; academic literature review; local narratives such as interviews, oral historical recordings, or existing video documentaries), remote community engagements (e.g., online workshops, forums, and seminars; virtual exhibitions, or NGO websites), conceptual and representational research environments (such as mapping and diagramming; temporal scenarios simulating possible on-site processes such as seasonal changes, water regimes, or community events, analog representational media constructing pre-meanings of place through fundamental concepts of architecture,[8] collages, drawing, film, or sound montages, booklets on the city and area named as "made in @..." the name of the studying city), interdisciplinary readings in ecology, sociology, and cultural geography or AI-assisted analyses (on thematic patterns through material or image recognitions) the model establishes a responsive framework for architectural education (Figure 4). Ultimately, SFL demonstrates how digital and site-based practices can converge to foster care-driven, place-sensitive, and critically engaged forms of design learning, where the studio becomes both a laboratory of ideas and a terrain of experience.

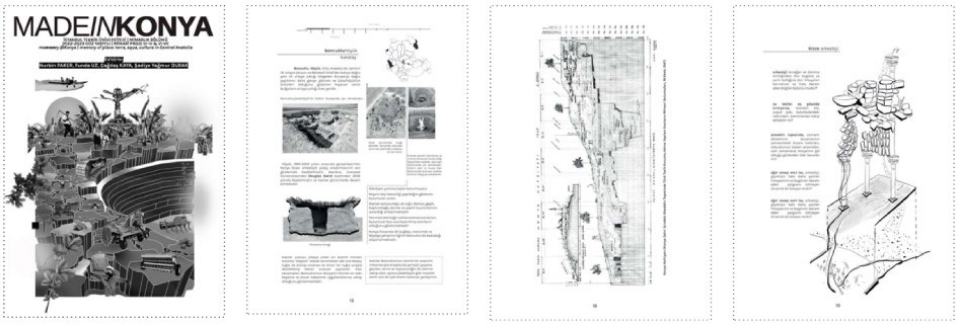


Figure 4. Pages from the referential guide books "Made in Konya" and "Made in Çanakkale" prepared by students through digital and analog data, where the trilogy of "data-information-knowledge" about ecology, urban-spatial, archaeology, art and culture, architecture of the related city is gathered and evaluated.

Considering the potential transformation that the Flipped Learning approach can generate within architectural design studio pedagogy, the aim is to propose a framework that prioritizes student active engagement, self-directed learning, and critical productivity rather than conventional models of knowledge transmission. In this context, SFL seeks to integrate diverse media environments with site-based learning settings in order to strengthen students' environmental sensitivity, empathetic engagement with place, and collective production practices. Within this hybrid and multi-layered pedagogical structure, students' capacities to "think with place" and "learn from place" are cultivated, while studio education is redefined as a dynamic learning environment operating between contextual awareness and critical action.

THEORETICAL FRAMEWORK - FROM CRITICAL TECHNOLOGIES TO SITUATED PEDAGOGIES: REFRAMING CLIMATE RESPONSIVENESS THROUGH SITUATED FLIPPED LEARNING

FL[9] represents an innovative pedagogical approach that transforms students from passive recipients of knowledge into responsible and active agents in their own learning processes. Grounded in four core principles such as "flexible learning environments", "student-centered learning culture", "purposefully designed learning content or strategically structured course materials", and "professional educator facilitation"; FL has the potential to enhance students' spatial awareness, critical thinking competencies, and collective production skills.[10]

In architectural education, this approach can be extended through SFL, which integrates asynchronous project preparation with site-based experiences and supports the structuring and implementation of active in-class and field-based practices. In this context, SFL repositions the studio not merely as a space for design production, but as an ecosystem of learning in which students develop self-directed learning, critical thinking, and collaborative production skills. By shifting educators toward the role of facilitators or mentors and by integrating multiple representational media with physical processes, SFL can be described as a model that enables active, site-sensitive studio experiences. This paper positions SFL as a scalable and transferable hybrid pedagogical framework that fosters empathetic, critical, and collaborative modes of learning, and argues for its relevance in reconfiguring contemporary architectural studio pedagogy.

SFL also aligns with recent research in resilience-oriented design education[11] as it frames climate adaptation not as a discrete curricular topic but as an experiential mode of learning. Studio sites ranging from the semi-arid geographies of Anatolia (Harran, Konya) to flood-prone coastal regions (Eskişehir, Sinop, Çanakkale); and current studio regions (Edirne, Ankara) become open laboratories where climate, culture, and communities intersect. Through cycles of asynchronous inquiry, preparatory work, and situated engagement, this process enables students to understand climate both as a material condition and a socio-spatial construct, fostering spatial empathy, collective responsibility, and critical modes of thinking.

From a pedagogical perspective, SFL redefines the studio as a hybrid learning ecology. Within this framework, climate sensitivity shifts from being a technical area of expertise to a mode of thinking and making. Learning becomes temporally and spatially multi-layered, with continuous transitions between asynchronous digital engagement and collective on-site production, as well as between abstract modeling and embodied experience. This structure strongly resonates with the four core principles of FL; "flexibility", "student-centeredness", "purposeful content design", and "educator's facilitating role";[12] and with the ethical and epistemic concerns foregrounded in climate-oriented design discourses. SFL repositions these principles within a contextual and site-sensitive pedagogical ground. Educators become facilitators who mediate between curated knowledge and embodied experience, guiding students to navigate uncertainty, critically interpret ecological data, and translate these analyses into context-responsive design propositions.

The SFL model, which integrates the knowledge worlds of "critical technologies" and "embedded pedagogies", offers a new paradigm for architectural education, in which learning itself becomes a practice-oriented ecosystem. In this context, the design studio functions not only as a laboratory of ideas but also as a space of experience, cultivating a learning environment attentive to innovations in human-ecological relations as well as in research and representational practices.

Finally, SFL demonstrates that climate sensitivity in architectural education is not only a matter of what we design, but also of how we learn. By interweaving site-based experience with critical reflection, this model positions learning itself as a climate practice, nurturing ecological imagination, social responsibility, and transformative agendas. In this context, the design studio shifts from being merely a laboratory of ideas to becoming a space of shared experiences, where technologies, materials, and human relations co-produce knowledge through situated and collective learning processes. In this sense, SFL is not only a pedagogical method but also proposes an ethics of learning; offering a framework through which future architects can engage with place, technology, and theory as interconnected agents of care, responsibility, and transformation.

METHODOLOGY - TRACING AND INTERPRETING DATA FROM THE STUDIOS

This study adopts a qualitative, multi-case research design to explore how SFL operates within diverse architectural studio contexts. The methodology emphasizes the interpretive and contextual nature of studio-based learning, aiming to uncover how theoretical frameworks of situated learning, embodied experience, and post-digital pedagogy (moving beyond the centrality of digital tools toward a contextual, critical, and experiential use of technology) intersect within the lived processes of architectural education.

The research is based on five long-format (semester-long) architectural design studios conducted between 2021 and 2024 in different regions of Anatolia, unified under the overarching theme of climate change and ecology. Each studio was selected for its distinct cultural, ecological, and spatial conditions and functioned as a microcosm for the development, implementation, and iterative refinement of the SFL pedagogical framework:

• Brutum Heroica (Çanakkale):[13] on memory, monumentality, and collective resilience.
• Minima Architecturas (Sinop):[14] on minimal interventions and adaptive spatial ethics.
• meMOORy (Konya):[15] on topographic memory and performative landscapes.
• Co-Healing (Eskişehir):[16] on approaches that frame architecture as a tool for social and environmental healing.
• Place & Memory_Harran (Şanlıurfa):[17] on the role of architecture in cultural continuity and the production of temporal imaginaries.

The data collection process is based on multiple types of qualitative evidence. These include student projects and studio outputs (drawings, physical models, digital representations, and reflective texts); instructor notes and observation reports (pedagogical strategies, classroom dynamics, and site-based processes); student–student (peer) interactions, and synchronous/asynchronous collaborative production practices. In addition, field documentation, student diaries, and materials obtained from digital storage platforms were examined, and processes related to transformations in students' cognitive and experiential learning modes were traced (Figure 5).

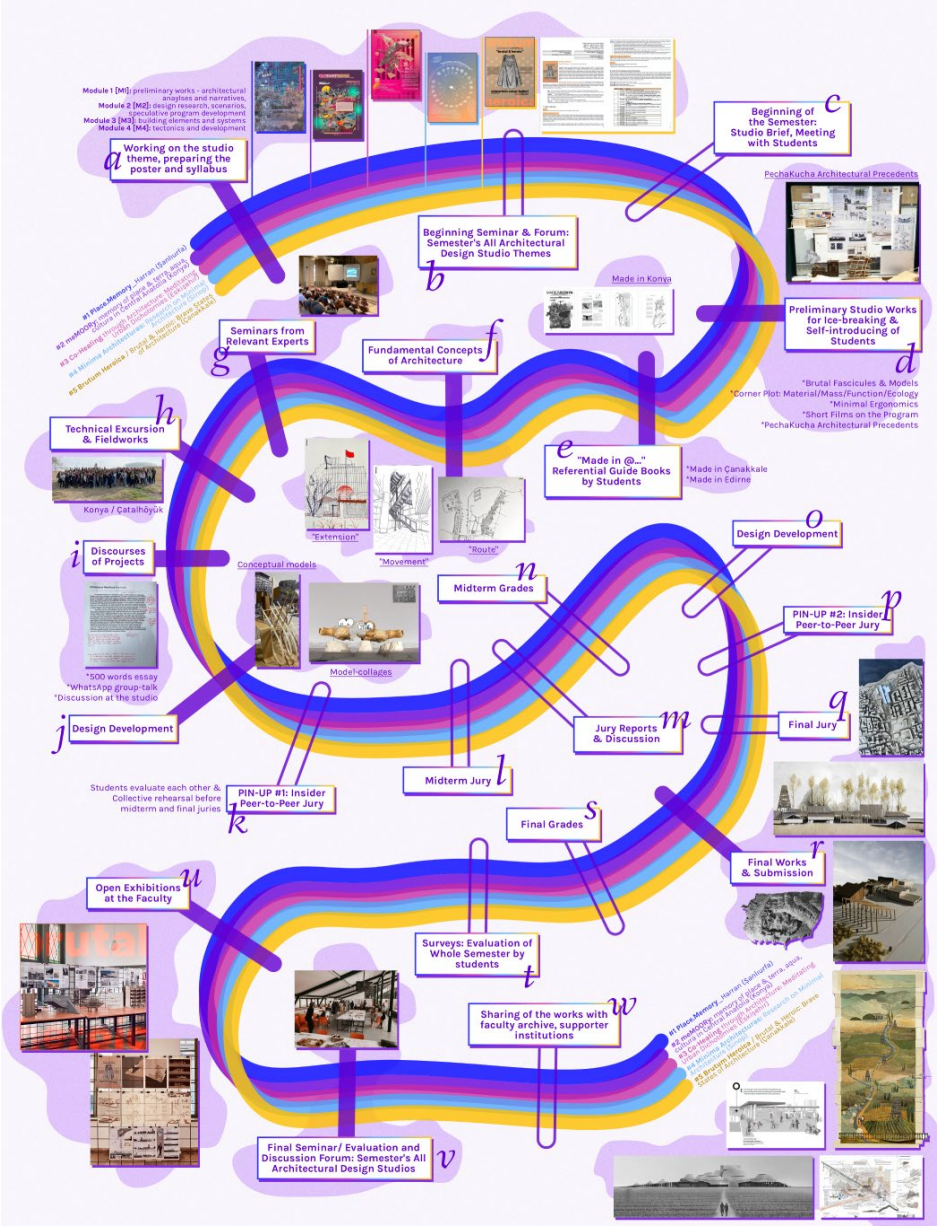


Figure 5. The data sets for this study are drawn from the five studio processes. Each semester-long studio is depicted with a different colored line, and the purple bends show the studio works with evidence (filled ones with detailed visuals and hollow ones with text).

During the analysis, these frameworks enabled a comparative evaluation of the studio experience across theoretical, experiential, and representational dimensions. Pedagogical patterns, spatial thinking strategies, and modes of collaborative learning emerging from SFL implementations were examined. Ultimately, this methodological approach situates learning not merely as an educational process but as an embodied, relational, and site-responsive practice, revealing how architectural studios can function as laboratories of both thought and terrain.

RESULTS AND DISCUSSION

The SFL studios generated consistent pedagogical outcomes in spatial awareness, contextual reasoning, collaboration, and instructional roles. Across sites, students shifted from abstract formalism toward situated spatial thinking, interpreting topography, climate, material conditions, and

sociocultural practices as active design parameters rather than contextual background. Exercises including “Made in @...” investigations, site-based seminars, in-situ observation, and analytical studies grounded design inquiry in lived environmental conditions.

Thematic frameworks, co-healing, resilience, brutal, minimal, and memory were translated into context-responsive architectural propositions. In Konya, ecological degradation, drought, agricultural infrastructures, and sinkhole geographies were examined alongside historical layers, producing adaptive typologies that positioned architecture between environmental transformation and cultural continuity. In Eskişehir, urban–physical dichotomies and water as both structuring and marginalized elements informed heterogeneous public interfaces. In Sinop, minimalism and restraint shaped reduced interventions and subtle urban strategies. In Çanakkale, glocal explorations of heroism, freedom, brutality, rural landscapes, and the strait linked geopolitical narratives to spatial practice. In Harran, semi-arid climate and agricultural-cultural layers structured site-based inquiry and collaborative production.

Collaboration intensified through asynchronous preparation combined with collective field engagement. Students co-developed analytical frameworks, mappings, and design scenarios, negotiating decisions through shared workflows that strengthened collective agency and critical dialogue. Instructors operated as facilitators, mediating between conceptual inquiry and embodied experience while coordinating logistical and temporal processes. This orchestration enabled students to navigate uncertainty, critically interpret ecological data, and translate contextual insight into design propositions.

Pedagogically, SFL positions the studio as a hybrid epistemic environment where knowledge emerges relationally through interaction with place, peers, and material conditions. By integrating flipped learning with site-based engagement, it redistributes learning across temporal and spatial dimensions, anchoring theoretical preparation in embodied and ecological realities. Implemented across diverse climatic and cultural contexts, the model demonstrates adaptability while fostering ethical attentiveness, spatial empathy, and climate-responsive design competencies. In this sense, SFL reframes architectural education as a practice of situated knowledge production oriented toward environmental and social responsibility.

CONCLUSION

To conclude, it must be said that the SFL offers an innovative pedagogical model that bridges theory and site-based engagement within contemporary architectural education. By integrating asynchronous theoretical inquiry with embodied field experience, SFL reconfigures the design studio as a hybrid learning ecology in which knowledge is not merely transmitted but produced through relational, contextual, and experiential processes. Through this approach, it responds to the growing need for pedagogical models capable of addressing climate change and ecological transformation not only as design topics, but as modes of learning.

The contribution of this study lies in demonstrating how SFL enables architecture students to cultivate context-responsive critical thinking and design competencies through recurring studio themes situated in diverse Anatolian settlements, studied in Istanbul Technical University's bachelor program of architecture. Each semester-long studio, structured around the overarching agendas of climate change and ecology, provided students with direct engagement in real-world conditions, strengthening their spatial awareness, ethical positioning, and collaborative agency. The development of a climate-focused syllabus across multiple studio cycles, and its visibility within platforms such as the Tulane Prize for Climate Change Curriculum in the Built Environment, further underscores the model’s curricular and institutional relevance.

Looking forward, future research may expand the empirical base of SFL through additional case studies and comparative analyses. The integration of emerging analog and digital media tools, including advanced 3D visualization and modeling technologies, offers further potential to enrich the hybrid learning environment. Moreover, international studio partnerships and cross-cultural collaborations could extend the model's transferability and test its adaptability across broader educational and climatic contexts. Through such developments, SFL can continue to evolve as a responsive and scalable framework for climate and place-oriented architectural pedagogy.

NOTES

[1] Lola Ben-Alon and Dimitris Papanikolaou, eds., *TAD: Climate: From Critical Technologies to Active Agencies, Technology | Architecture + Design* 8, no. 1 (2024).
[2] This risk became particularly visible during the COVID-19 pandemic, when achronological learning practices became widespread. The intensive use of online platforms such as Zoom, Ninova, Mural, Miro, and Teams diversified synchronous and asynchronous interactions in studio education; however, it also produced a new pedagogical configuration that could not fully substitute for place-embedded, embodied, and socio-spatial encounters.
[3] Kiel Moe, "The Twilight of the Models", *Log* 56 (Fall 2022): 37–47.
[4] Ronald Barnett and Norman Jackson, eds., *Ecologies for Learning and Practice: Emerging Ideas, Sightings and Possibilities* (London: Routledge, 2020).
[5] "Curated readings" denote thematically organized selections of texts that guide students' theoretical and critical framing prior to studio engagement.
[6] "Contextual atlases" refer to multi-layered mappings and visual documents that synthesize spatial, historical, ecological, and socio-cultural data of a specific site, enabling students to situate their design inquiries within lived and contextual realities.
[7] "Preparatory engagement" denotes students' active participation in pre-class learning to support reflective and informed studio work.
[8] Students select two concepts from the book "Fundamental Concepts of Architecture" and draw five sketches for each concept during the technical excursion and fieldworks. For instance, concepts such as "threshold", "sound", "extension", "framing", "movement", "interior", "wall", "circulation" and many more, are traced and caught by the students at the related city trip. A student can draw the "sound" concept in the rurals of Konya, or another student can draw and paint exterior "walls" of Sinop city centre in his/her sketchbook in order to grasp the contextual parameters of that city, and to later use in their development of architectural projects. These sketches are essential for being produced in the field, and offer a prolonged gaze compared to directly photographing and forgetting the field. See: Alban Janson and Florian Tigges, *Fundamental Concepts of Architecture: The Vocabulary of Spatial Situations* (Basel: Birkhäuser, 2014).
[9] FL Initiated by Jonathan Bergmann and Aaron Sams in 2007, the method has evolved into a comprehensive pedagogical model within the framework of "Flipped Learning 3.0 (FL3)", supported by international standards and implemented at institutions such as Harvard and Stanford University. See: Bengi Birgili, Fatma Nevra Seggie, and Ebru Oğuz, "The Trends and Outcomes of Flipped Learning Research between 2012 and 2018: A Descriptive Content Analysis", *Computers & Education* 146 (2021): 103751.
[10] Mousumi Chaudhari and Raj Lakshmi, "Flipped Learning in Higher Education", *Journal of Emerging Technologies and Innovative Research* 6, no. 4 (April 2019): 445–449.
[11] Ben-Alon and Papanikolaou, *TAD: Climate*.
[12] Chaudhari and Lakshmi, "Flipped Learning in Higher Education", 445-449.
[13] "brutum heroica | brutal & heroic: radical expressions of architecture" (2024-2025 spring) architectural design studio reconsiders the controversial yet powerful legacy of Brutalism within the context of contemporary ecological and social vulnerabilities. Through the concepts of the "raw, clear, pure, and modest", the studio aims to develop architectural visions that are bold yet responsible. The selected site, Çanakkale-Gelibolu-Eceabat offers a "brutal & heroic" spatial condition shaped by war memory, monumentality, and the stark strength of its coastal topography, intersecting with Brutalism's pursuit of clarity, honesty, and structural expression. The process is grounded in a research-by-design model. It advances through modules of analysis, speculative program development, and system and tectonic exploration, supported by site visits, seminars, short film production, and multi-scalar representation tools, fostering a critically engaged and productive studio environment.
[14] "minima architecturas | research on minimal architecture" (2023-2024 fall) design studio approaches the concept of the "minimal" as a tool for investigating the idea of the happy individual and the happy city in an age of uncontrolled urban sprawl and environmental crises. The aim is to design fair, healthy, and productive living environments that reduce unnecessary consumption through principles of simplicity, functionality, and naturalness. Through the concept of adaptiogenesis, the studio explores architecture as a flexible, self-organizing system capable of adapting to environmental change. The selected site, Sinop, provides a distinctive context where the Black Sea's stark geography, strong winds, coastal topography, and small-scale settlement fabric make the impact of minimal intervention visible. İnceburun's vast northern landscape, Gerze's quiet coastal

character, and Sinop's historic port identity allow themes of "achieving more with less", lightness, temporality, and adaptability to be spatially tested. The process advances through a research-by-design model, including urban narrative exercises and speculative program development modules.

[15] "meMOORy @Konya | memory of place: terra, aqua, cultura in Central Anatolia" (2022-2023 fall) architectural design studio investigates the memory of place through the intertwined layers of land, water, and culture in the Central Anatolian Konya Basin. Moving beyond the nature–culture dichotomy, it aims to design sustainable spaces of production in relation to agriculture, water regimes, and the climate crisis. Konya's historical agricultural accumulation, water resources under the threat of drought, and its archaeological and rural strata provide a strong contextual ground for developing productive, sustainable spatial programs that generate knowledge for the future. Grounded in a research-by-design model, the studio progresses through place-memory workshops, field trips, and speculative scenario and program development, ultimately aiming to propose healthy and resilient living environments shaped by ecological and social foresight.

[16] "co-healing through architecture | meditating urban dichotomies" (2022-2023 spring) architectural design studio approaches architecture as a practice of mediation and healing between urban oppositions and dichotomies. Its aim is to translate the concepts of eudaimonia and ikigai into spatial programs that foster happiness, well-being, and collective recovery. The selected site, Eskişehir, functions as a contextual laboratory with its dense young population, layered urban structure, and cultural diversity, making visible a range of social, spatial, and ecological dichotomies. Grounded in a research-by-design model, the studio advances through conceptual mapping, precedent analysis, site visits, scenario building, cross-programming, and system and tectonic design modules. It ultimately seeks to produce fair, inclusive public and semi-public spaces that support well-being and shared urban life.

[17] "place & memory | Harran [Şanlıurfa]" (2021-2022 spring) architectural design studio explores the distinction between history and memory through spatial production. The selected site, Harran–Şanlıurfa, offers a multilayered cultural landscape shaped by its position at the crossroads of ancient trade routes between Mesopotamia and Anatolia, the cult of the Moon God Sin, the Harranian Sabians' belief system, and its medieval scientific legacy. Its 5,000-year continuity of settlement remains legible in the mound, city walls, and traditional earthen dwellings. Grounded in a research-by-design model, the studio advances through place-memory workshops, field trips, and speculative program development, aiming to generate sustainable, site-specific architectural proposals rooted in historical consciousness and spatial continuity.

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COMPLICATING ARCHITECTURAL SUSTAIANBILITY LEARNING

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INTRODUCTION

As our design settings become increasingly more complex and volatile, with social and political issues of inequity at the fore of escalating ecological issues, the next generation of architects who will face these challenges need to be capable of working within and mediating a myriad of evolving complexities. Traditional architectural education, however, tends to introduce students to design through formal-operational design decision making, focusing on the form, function, and performative metrics of a singular design solution as opposed to training them to start with site-specific studies of social and environmental need. Perhaps unsurprisingly with this formal design logic as a shared foundation, in architectural academia our discourses that surround sustainability tend to follow these kinds of logics as well, searching for commonalities and ubiquitous solutions. Architecture can play an essential role in helping to promoting environmentally responsible communities, but to effectively do this, architectural education must challenge students to approach sustainability as a multidisciplinary, multi-locational, and multi-scalar design challenge.

This paper argues that sustainability design pedagogy needs to prioritize communication skills and situated creativity and cognition. This assertion is made through a critical reflection on the experiences of a series of sustainability courses that confronted the limitations of teaching traditional, architectural performance-focused sustainability and instead explored how architectural design learning can integrate ongoing communication with various project-related stakeholders and partners, can address sustainability at multiple scales and through multiple frameworks of focus, and can draw inspiration from a range of sources, local to global. Through these classes, it was noted how classroom discussions and design learning is enriched with a multidisciplinary group of students studying sustainability—which highlighted the potential for these rich (or thick) discussions to impact design thinking and design process at multiple stages and scales.

This paper argues that architectural education must challenge students to approach sustainability as a multidisciplinary, multi-locational, and multi-scalar challenge. This claim is founded on the observational analysis of several multidisciplinary sustainability courses taught in the last three years at Ball State University. In one class, taught multiple semesters, students worked in multidisciplinary teams to build proposals with university partners to improve sustainability learning on their campus through a series of campus interventions. In a second class, students traveled on a sustainability-focused study abroad trip to examine various embedded sustainability agendas at multiple of scales of application. In a third class, students experienced a situated epistemology working within

multidisciplinary design teams in direct collaboration with various community partners and potential residents. In this collection of teaching experiences, certain underlying focuses proved useful in all the classes: cross-disciplinary communication skills, multi-locational learning, and situated creativity.
This analysis ties in theories of situated and immersive learning into design pedagogies to substantiate a multidisciplinary curricular approach that is open and responsive to situated issues of ecological, social, and economic sustainability. This paper presents the initial discovery phase of a continuing study.

COMMUNICATION

A primary learning objective in all these courses was a focus on discourse and cross-disciplinary communication as foundational sustainability design skills. Design teams shared multidisciplinary knowledge to effectively examine a variety of sustainability lenses that founded an exploration of social constructions of place and community. From an architectural perspective, these lenses are not exclusive to each discipline, nor are they entirely disparate from traditional architectural design approaches, but this focused communication productively informed situated, co-generative design thinking.
The structure of the class discourse was based on Lave and Wenger's *Community of Practice* in which members of a community actively engage to learn from each other.[1] This learning happened through a series of course exercises. First, the class took advantage of the students' various disciplinary backgrounds and built a basic foundational knowledge map that referenced both the students' disciplinary knowledge and personal interests to understand the various informed perspectives present. Students listed the classes they've taken that have addressed sustainability or have informed their thinking about sustainability. Students listed projects they've worked on—in class or out—that have tackled sustainability in some way. They listed their hobbies and/or interests.

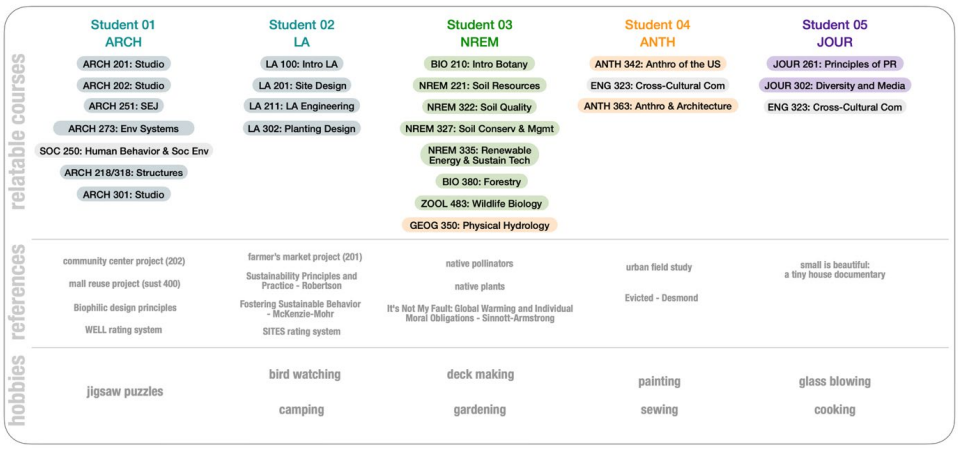


Figure 1. Knowledge mapping.

The class then talked about the embedded biases that accompany the various perspectives and how the class can intentionally take advantage of these. For example, one student was an avid biker. That student knew which local streets had good bike lanes; they were aware of how bike paths connected to different areas of our city; when they look at a street they see the width of the street through the lens of biking. This is an awareness—a way of seeing the world—that is unique to someone who bikes. Embedded in the way we see the world are our individual perspectives—lenses that relate to our interests—and working to get to know each other's lenses in a classroom creates a shared understanding of what everyone can add to the course conversation. This can be used to create a

diagram that clearly delineates how each person in the group can add to the conversations and project ideations in multiple ways.

Implicit in teaching sustainability in a multidisciplinary group of students is the need to back up and address some very foundational questions: What is sustainability? How does one frame the topic? How does one question if something is a sustainable approach? We talk about language and how our disciplines impress on us certain ways of talking about issues or challenges or assessments in our field. Students who are embedded in their foundational disciplinary learning don't always realize the extent to which they are being trained to think about, communicate, and frame the world differently. Talking about this, and talking through these differences, allows the students to more effectively be able to talk with each other across their disciplinary differences. This examination of the various disciplines' language allows students to intentionally build a foundation from which to start the class project discourse.

For every multidisciplinary course, the first two weeks are used to work through a series of foundational readings and the class bases discussions of the readings on how having multiple perspectives adds strength to the understanding of any design challenge. For example, one reading that has been especially useful is Guy and Farmer's "Reinterpreting Sustainable Architecture: The Place of Technology."[2] Even though it is two decades old, it presents a diagrammatic way of thinking about and categorizing sustainability logics. The class uses this framework to discuss difference as an applicable strength. The class talks through which of these logics resonate with each of their disciplines and which of these logics echo individual perspectives and interests in sustainability, highlighting the advantage of having differing perspectives and different expertise related to sustainability. These classes also typically read a chapter of David Orr's *The Nature of Design* that talks about how ecological thinking must become a kind of public pedagogy that is embedded in our everyday spaces and places and students think about how their interests can inform specific sustainability agendas that can start to define potential design agendas.[3] Identifying the different student voices early allows the class to use those differences as an asset when we move on to group project or design work.

Table 1 The six competing logics of sustainable architecture

Logic	Image of Space	Source of Environmental Knowledge	Building Image	Technologies	Idealized Concept of Place
Eco-technic	global context macrophysical	technorational scientific	commercial modern future oriented	integrated energy efficient high-tech intelligent	Integration of global environmental concerns into conventional building design strategies. Urban vision of the compact and dense city.
Eco-centric	fragile macrobiotic	systemic ecology metaphysical holism	polluter parasitic consumer	autonomous renewable recycled intermediate	Harmony with nature through decentralized, autonomous buildings with limited ecological footprints. Ensuring the stability, integrity, and "flourishing" of local and global biodiversity.
Eco-aesthetic	alienating anthropocentric	sensual postmodern science	iconic architectural New Age	pragmatic new nonlinear organic	Universally reconstructed in the light of new ecological knowledge and transforming our consciousness of nature.
Eco-cultural	cultural context regional	phenomenology cultural ecology	authentic harmonious typological	local low-tech commonplace vernacular	Learning to "dwell" through buildings adapted to local and bioregional physical and cultural characteristics.
Eco-medical	polluted hazardous	medical clinical ecology	healthy living caring	passive nontoxic natural tactile	A natural and tactile environment which ensures the health, well-being, and quality of life for individuals.
Eco-social	social context hierarchical	sociology social ecology	democratic home individual	flexible participatory appropriate locally managed	Reconciliation of individual and community in socially cohesive manner through decentralized "organic," nonhierarchical, and participatory communities.

Figure 2. The six competing logics of sustainable architecture.

A second learning objective for a multidisciplinary group of students in these classes is learning how to effectively communicate design thinking when many students are not from design disciplines. Based on the theory of *Peripheral Participation*, the class uses a shared drawing roll as a means of

everyone becoming more fluent in discussions about design and the practice of design ideating."[4] The preceding discussions about disciplinary difference makes students actively recognize that sketching communication is a learned skill, and students are encouraged to use whatever means they are comfortable with to communicate their design priorities and ideas. Because of their familiarity with each other's various expertise, they are open to various types of input and tend to feel free to try new things and communicate in different ways; words, poems, descriptions, and pasted photographs become a part of the design space on the paper.



Figure 3. Shared drawing roll.

Through these exercises and workflows, class dialogues consistently produced fruitful and creative design trajectories that allow for a questioning of normative sustainability design assumptions. Treating cross-disciplinary differences as a foundational value creates a learning space where students feel more comfortable expressing their own ideas and opinions, and this significantly elevates the role of group discussions in any design process. The students learn to listen to each other, work effectively together, and as a team, productively process critiques from project partners. Multidisciplinary communication skills need to be an integral focus of any sustainability design learning. Reframing sustainability design as an on-going, cross-disciplinary, situated dialogue focuses student learning on skills that can be applied in a variety of design contexts and at different scales of design thinking. This focus on communication prioritizes open-minded creativity and situated design learning.

MULTI-LOCATIONAL LEARNING

The built environment and cultural norms are co-constitutive and our built landscape plays a fundamental role in perpetuating this relationship. The extent to which our social patterns of consumption, waste, space use, etc. are endemic and structural tends to reside outside the active awareness of a large portion of our population and we tend not to question our normal conditions. A third learning objective of these courses was a focus on multi-locational learning. In order to explode assumptions about everyday patterns of life, sustainability design learning needs to incorporate the experience of different spaces and places. Founded on the concept of *Habitus*, travel can offer students the opportunity to explore other places and cultures; witness different ways of being in the world.[5]

A sustainability abroad course taught in the summer of 2025 leveraged the multidisciplinary backgrounds of the students to create an ongoing, cross-disciplinary, place-based examination of

sustainability. To build a foundation for the class travels, students choose one of the cities in the itinerary and each student researched a sustainability focus, or project, or program that their city was implementing or manifesting. Discussions were held ahead of time about the multidisciplinarity of our group and students were asked to lean into their interests and specialties for this preparatory assignment work. When traveling, the class held regular student-lead discussions where the students taught each other about their chosen city and topic. This offered the students the opportunity to see the cities through each other's lenses of interest. Through these student-led discussions, aspects of the cities were highlighted that would not have been a part of typical architectural sustainability coursework. This allowed students to see aspects of the cities that were important to someone with a different viewpoint, and they were able to see very different ways of doing things or organizing the everyday because they were in foreign places. Student-led discourse continually reframed the focus for parts of the travel and became integral to the learning process.[6]



Figure 4. Student-led discussions.

This sustainability abroad program used mobility as a pedagogical tool, challenging traditional architectural study through an active exploration of lived geographies.[7] This situated learning examined each city, each route, every place as a "text to be read" and functioned as a form of architectural field inquiry.[8] Walking tours and focused discussions were led by local experts whose expertise was grounded in place-based knowledge which offered contextual perspective fundamental to experiential learning.[9] Students experienced what good public transportation can be; they saw green spaces embedded in dense urban areas in delicate ways they tend not to think of in the midwestern United States; they experienced cities that have prioritized different public amenities—in Zurich, for example, every public water fountain is drinkable water. These experiences exposed students to places with different social, political, and ecological priorities. The variety of built landscapes instigated discussions of social value in architectural design and provided inspiration for sustainability design ideating at multiple scales of application.



Figure 5. Drinking water.

While there often isn't the time or the resources to support significant travel as a part of an architectural curriculum (and not all students can afford to participate in study abroad opportunities), one can always lean into any traveling the students have done. In classes, students can talk about their interests and how related spaces have been differently experienced elsewhere. Students are assigned to find precedents from elsewhere in the Unites States and elsewhere in the world. Students focused on specific project agendas are expected to ask if any of the other students have seen or know of different precedents.

Multi-locational learning allows students to witness alternate solutions and different ways of approaching sustainability through design. Through these discourses, students gain an awareness of how our social norms and existing environmental problems are embedded in our built landscapes; and through the interrogation of a series of places, they built an understanding of how different cultural priorities can manifest various applications of sustainability in the built environment.

SITUATED CREATIVITY

For sustainability to effectively be a part of any design process, the focus needs to be situated even though the challenges are scalar. A fourth learning objective for these courses was a focus on situated experience as a foundation for design ideating. In these courses, the students lean into their disciplinary differences as a foundation for design thinking, highlighting the various learned instincts that are present in the class. Each student will lock into a different aspect of a design challenge based on their discipline and/or personal interests, and these ideas often differ in scale and in focus. The course's starting point for design is an examination of place. The class walks the site; walks the neighborhood—and students are asked to record their experiences though sketching, mapping, or taking notes. Starting this process with as little direction as possible offers another opportunity to incorporate different ways of thinking and prioritizing into the initial design exploration. The kind of information the students gather and how they document it varies greatly if they are given this freedom.

After the class builds an initial impression of a place or neighborhood, the students are introduced to methods of gaining a sense of community perspective and students look to local sources like news postings, community groups, or coffeeshop boards. The class uses these to identify meaningful questions about the project agenda. Focusing on questions, instead of trying to define project goals

beyond basic sustainability agendas, ensures that the students are not pushing their own ideas before collaborating with partners. These questions function as a conversation starter with community or project partners who then help the class to define and refine project goals. These conversations help students to build a deep understanding of the needs of a community.

Because of the class's foundational work on cross-disciplinary communication, students are able to effectively talk with and work with a variety of people with differing perspective and agendas. For example, in a tiny house village project a couple of year ago, the project partners included: the local mayor, a city planner, the city comptroller, a homeless shelter representative, and neighborhood residents—all who held very different opinions about the project. The students were extremely receptive to the various perspectives because these conversations followed their own examinations of difference within the class itself. These dialogues confronted issues relating to sustainability including economics, resiliency, management planning, accessibility, and buildability.



Figure 3. Project partner meeting.

Architects must embrace their ethical responsibility as stewards of the built environment through engaging meaningfully with place through place-based experiential learning.[10] Community partner collaboration offers students the opportunity to experience the embedded quality of productive sustainability design work.

CONCLUSION

Long term sustainability will require a shift in societal priorities, away from a culture of consumption and assumed affluence, and toward a studied focus on dialogues addressing social needs and ecological priorities. Instead of leveraging common typologies and seeking ubiquitous solutions, the discipline of architecture has an obligation to contribute to a rethinking of sustainability learning as a continuing conversation that recognizes the changing conditions of emerging ecological and social issues. Through an examination of a series of multidisciplinary sustainability design courses, this paper pushes against the idea of traditional design learning based on a top-down critique of design output and instead addresses sustainability design as a continuing multidisciplinary dialogue that interrogates the context, goals, and conditions of a design agenda.

These analyses demonstrate how an inquiry-based course structure focused on communication, multi-locational learning, and situated experiential learning can effectively expand the purview of sustainability design learning. This focus on leveraging different perspectives and knowledge bases as a foundational starting point allows for a classroom where students become aware of how much they

can learn from each other beyond the curricular objectives. All these classroom techniques, makes for a space that is especially productive for grounded design thinking and intentionally exploring alternate sustainability perspectives and agendas. The architecture students tend to be more willing to try new ideas and move past typical architectural sustainability approaches because of the multidisciplinary focus of these classes. Student projects incorporate ways of thinking and prioritizing that push beyond typical architectural sustainability. The multidisciplinary discourse and place-based inquiries provided cognitive and ethical foundations for the students' design approach and demonstrate how multidisciplinary and multi-locational exploration can expand the potential implications of sustainability design.

This paper is the foundation of an ongoing mixed-method study that will expand the pedagogy of sustainability design learning. The second phase of the study—outside the scope of this essay—will entail operationalizing data collection methods to support nuanced pedagogical claims with quantitative and qualitative data.

We require a rethinking of sustainability design education that frames design as an on-going process of continuing place-based inquiry. Sustainability solutions cannot be universal nor is sustainability something that can be solved through a single design application. Location-specific social and environmental design experience needs to become an intrinsic part of architectural curriculum, but to effectively do this, architectural education must challenge students to approach sustainability as a multidisciplinary, multi-locational, and multi-scalar challenge.

NOTES

[1] Étienne Wenger, *Communities of Practice: Learning, Meaning, and Identity: Learning in Doing: Social, Cognitive, and Computational Perspectives (Cambridge: Cambridge University Press, 2005).*
[2] Simon Guy and Graham Farmer, "Reinterpreting Sustainable Architecture: The Place of Technology," Journal of Architectural Education Vol. 54, No. 3 (2001): 141.
[3] David Orr, "Human Ecology as a Design Problem," in *The Nature of Design : Ecology, Culture, and Human Intention* (Oxford: Oxford University Press, 2002), 31.
[4] Jean Lave and Étienne Wenger, *Situated Learning: Legitimate Peripheral Participation* (New York: Cambridge University Press, 1991).
[5] Pierre Bourdieu, *Outline of a Theory of Practice*, trans. Richard Nice (New York: Cambridge University Press, 2013), 85; Kim Dovey, "The Silent Complicity of Architecture," i*n Habitus: A Sense of Place,* ed. Jean Hillier and Emma Rooksby (Burlington: Ashgate Publishing Limited, 2005), 284.
[6] Bell Hooks, *Teaching to Transgress: Education as the Practice of Freedom* (New York: Routledge, 1994).
[7] David A. Kolb, *Experiential Learning: Experience as the Source of Learning and Development* (Englewood Cliffs, NJ: Prentice-Hall, 1984).
[8] Peter A. Machonis, ed., *Shatter the Glassy Stare: Implementing Experiential Learning in Higher Education*, National Collegiate Honors Council (Birmingham, AL: Commercial Printing Company, 2008).
[9] David A. Kolb, *Experiential Learning: Experience as the Source of Learning and Development* (Englewood Cliffs, NJ: Prentice-Hall, 1984).
[10] David Leatherbarrow, *The Discipline of Architecture,* ed. Andrzej Piotrowski and Julia Williams Robinson (Minneapolis: University of Minnesota Press, 2001).

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DRAWING AIR AT WINDOW OPENINGS

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INTRODUCTION

The air we breathe connects us intimately to other breathing bodies in the spaces we inhabit and beyond. Air is continuous and has no borders. Air is invisible in its default state, and thus easy to forget and neglect. Philosopher Tonino Griffero describes air as a 'quasi-thing' that occupies the space 'between sensorily-perceived qualities and tangible things'.[1] The air inside buildings determines building health, human health and comfort. The ability to read the air in a room can enable diagnosis of some of the root causes of building failure (e.g. mould) and ensure the longer term survival of buildings.[2] The Covid-19 pandemic and health risks caused by air pollution[3] have brought renewed attention to air.

While air does feature in architectural education, it is often siloed within environmental science and is not given meaningful consideration in design work. This paper describes a case study that forms part of PhD research which explores if foregrounding air within architectural education can raise awareness of air and prompt exploration of its role in design of the built environment. The research explores if hand drawing can engender a more holistic understanding of air, and transform perception of air from ephemeral, 'quasi-thing' to a tangible substance that can be shaped by design.

A workshop called 'Airing Out' was delivered to second year undergraduate architecture students in University College Dublin (UCD) as part of a core technology module. The workshop, completed by 59 students in 2024 and 69 in 2025, aimed to raise awareness of air by studying how an existing window mediates air and how that air affects interior environment. It sought a nuanced understanding that explicitly linked the performance of air in buildings with social, cultural, societal issues and climate change, a 'cultural-aesthetic perspective'.[4] The pedagogical approach and student output are briefly described here: the focus is on the student hand drawings.

ARCHITECTURAL EDUCATION

Architecture schools have resisted change. The nineteenth-century Beaux Arts model prevails; the studio-master directs the student-disciple in a hierarchy that overvalues the teacher and privileges the visual.[5] The literature recognises the need for new pedagogical models that foster student-led learning, inclusivity and empathy.[6] An 'integrated curriculum' model means placing concepts and themes horizontally and vertically,[7] breaking silos, allowing connections to be made between local climate, contemporary construction methods and broader issues in architectural education. 'Constructive alignment' supports learning by ensuring that learning outcomes match assessment methods.[8]

UCD's technology module[9] aims to develop understanding of the fundamental principles of construction. It consists of a weekly lecture where knowledge is transmitted in a one-directional manner by the lecturer (as authority) with minimal student participation and a weekly studio where students complete tightly prescribed, technical drawing assignments based on the lecture content, guided through group tutorials, whose usefulness depends on the tutor's skill. Tutors often dominate due to the asymmetrical relationship between tutor and student.[10]
The 2024 workshop participants had encountered air in an environmental science module. This module was not delivered to the 2025 cohort.

Hand Drawing

The process of drawing can make visible the invisible through economical means.[11] Drawing is a practice native to architecture.[12] Hand drawing is forgiving, allowing lines and layers to be added, removed, revised at ease through its 'natural vagueness and innate hesitancy' and aids the cognitive process of learning.[13] UCD Architecture has a tradition of excellence in hand drawing, which prevails alongside digital and hybrid methods,[14] making the school a suitable location to explore its pedagogical potential. Digital drawing offers different possibilities beyond the remit of this study, intended for future research.

RESEARCH DESIGN

The research is qualitative. The primary data, consisting of student-selected images, student drawings, texts and conversations, is supplemented with questionnaires and the researcher's field notes. The drawings were examined using content analysis, a method described as objective, structured and quantitative.[15] This paper focuses on student outputs from 2024 and questionnaire responses from 2024 and 2025.

Workshop Description

The brief was introduced on a Monday in advance of a two-hour workshop the following Wednesday. The four individual assignments were uploaded to a shared, online gallery;
A. select an image of air from any artform
B. observe the air at a window opening of your choosing
C. draw observations of air
D. reflect in writing
The workshop aimed to inform each student's approach to assignments B and C, completed in their own time afterwards. The finished drawings were reviewed in class one week later, partly through a quiz that required viewing the drawings for answers (e.g. choose the drawing that best represents how air changes), ensuring that every student benefited from the collective knowledge.

Workshop Design

Introducing air as a lens to study window openings and interior environment within technology represents horizontal curriculum integration: air traditionally resides within environmental science and window location within design studio.
The workshop combined individual with group work within a student-led, arts-based approach that featured peer-to-peer and experiential learning. The brief explicitly encouraged exploration and suggested empirical observation, that students measure the air using their own body, described as a 'portable environmental laboratory',[16] as distinct from using tools and equipment. Students could choose how they completed assignments, allowing them to construct meaning through their activities, marking a shift from tutor-dominated to student-led learning.

Arts-based research, at the intersection of art and science,[17] underlies assignment A. The images collected served as prompts for the workshop, which took the form of guided, small-group discussion of a question, to prompt reflection, position-taking and critical thinking.[18]

Experiential learning underlies assignments B and C: the student learns through their experience rather than acquiring knowledge that is transmitted to them. Donald Schön claimed that students cannot be taught but rather learn through doing, under the guidance of their teachers.[19] 'Reflection-in-action' occurs when completing assignments, and 'reflection-on-action' while reviewing and reflecting on work.[20]

THE STUDENT WORK

Visualising Air - Assignment A

Assignment A asked each student to select an image that depicted air at a window opening, from any artform. The 57 images include paintings (12), drawings (2), film stills (9), and photographs (26). 10 students presented their own work. The images generated a conversation that touched upon air as life, light, health, well-being, weather, wind, war, natural disaster, death, disease, dust, fog, perfume, pollen, pollution.

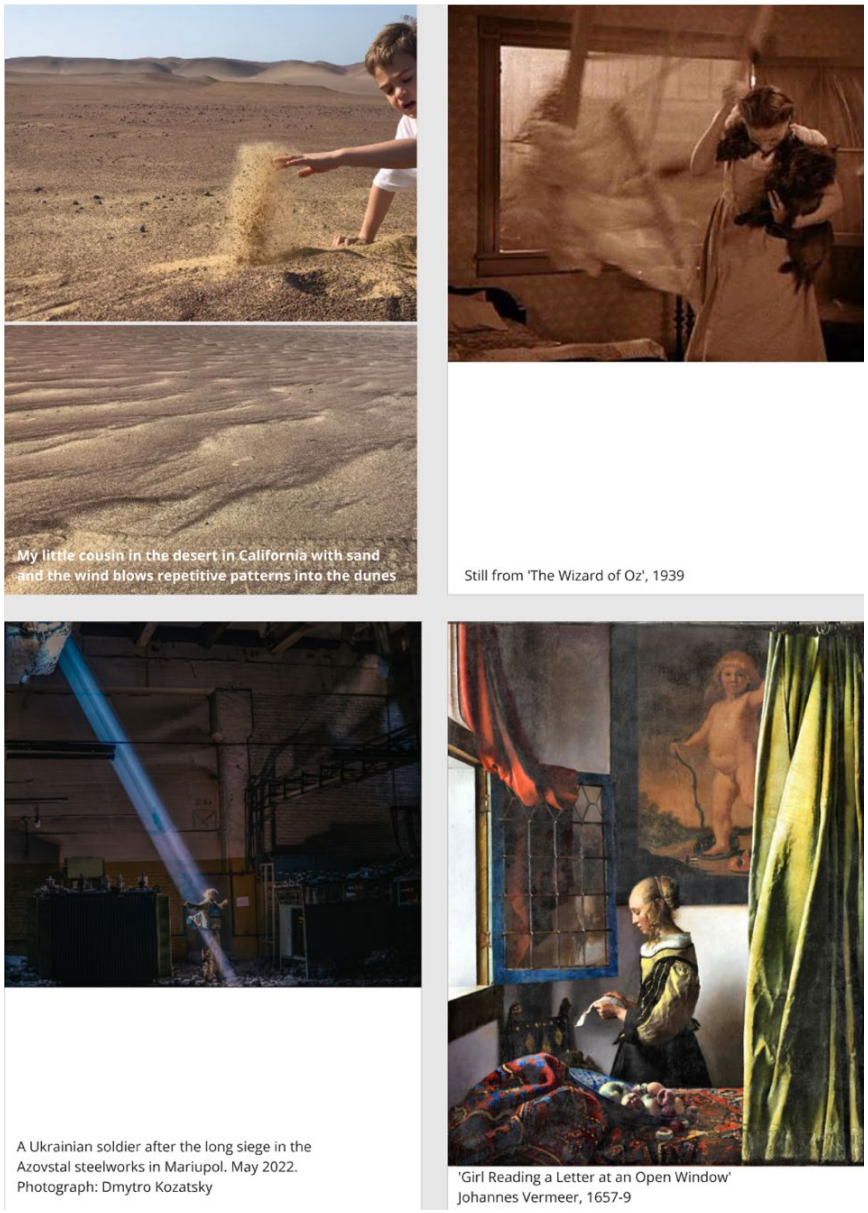


Figure 1. A selection of images depicting air

Observing Air - Assignment B

Assignment B asked each student to observe the air at a window of their choosing using a low-tech method of their own devising. Students selected hopper, sash, pivot, tilt-and-turn, roof lights and sliding windows. Bedrooms dominated, but bathrooms, kitchens, a music room, bus and train also featured. Air temperature, flow, humidity, smells, sounds, light, and change were observed, using annotated sketches, tables, photographs, sound and video recordings. Many chose to observe air through its effects on a candle flame, diffuser, wind chimes, or curtains.

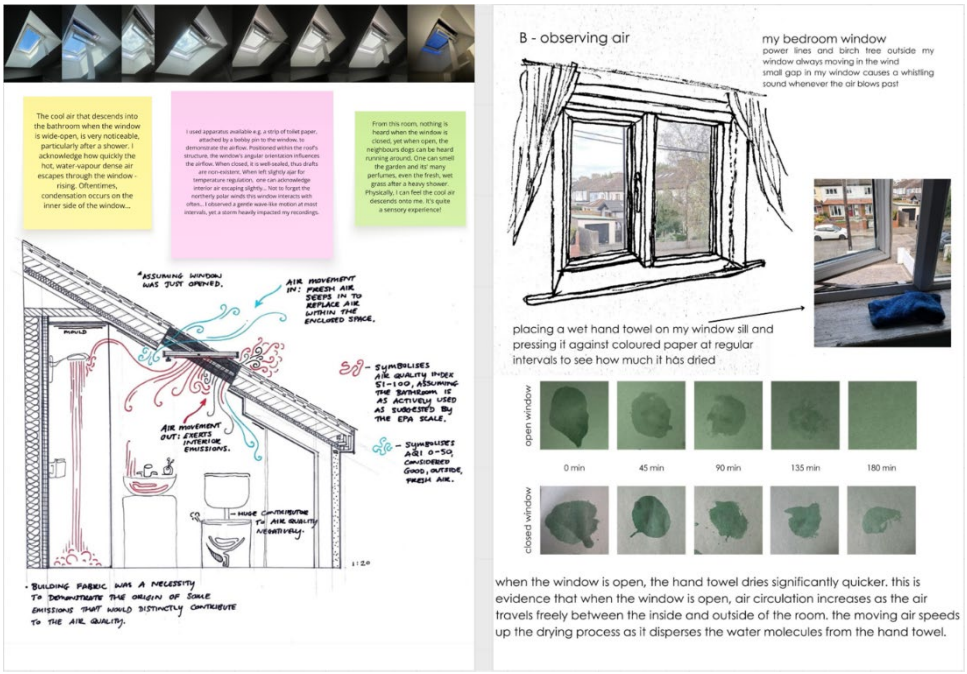


Figure 2. A selection of observations of air

Drawing Air – Assignment C

Assignment C asked students to make a drawing that represents the air observed. All interpretations of 'drawing' were accepted. 49 of the 54 drawings were hand drawn, unsurprising given that students had drawn by hand through first year and were unfamiliar with digital drawing.

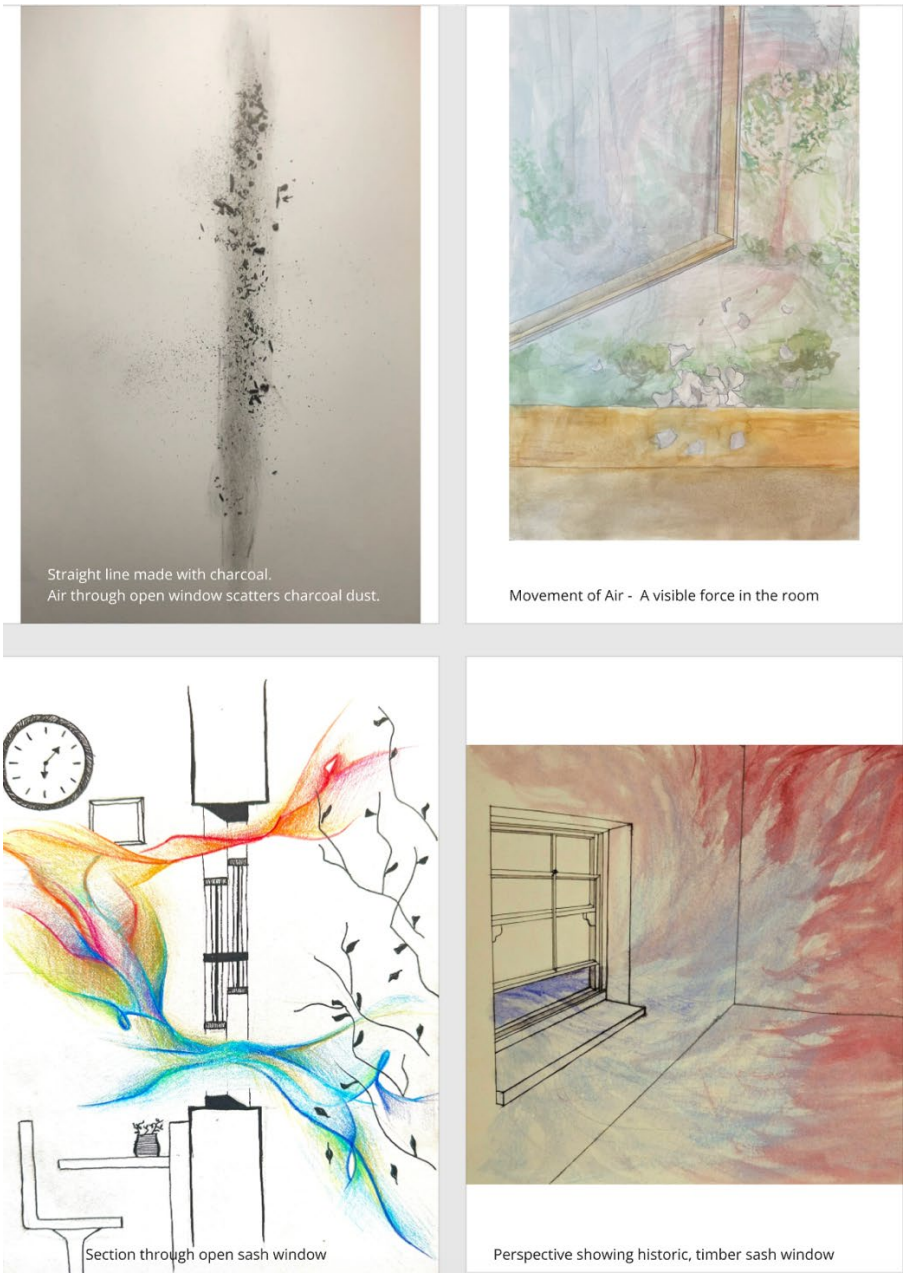


Figure 3. A selection of drawings representing air

24 drawings are pictorial. 28 orthographic projections[21] include section (20), plan (6), elevation (5), and axonometric (1). 34 drawings depict a single moment, whereas 20 depict a series. 17 are monotone, 20 use red and blue while 17 are multi-coloured. Media pencil (18), water colour (12), chalk pastel, oil pastel, colouring pencils, charcoal, ink, and acrylic. Three themes dominate: air movement (34), warm and cool air mixing (23) and the temporal nature of air (17). Drawings also represent ventilation (11), moisture content (7), sound (5), light (3), smell (3), and air quality (2). Time is explicitly represented in 17 drawings and implicit in others.

Student Feedback

18 student questionnaires[22] refer positively to the brief's openness noting 'freedom' and 'room for creativity'. 5 critique the brief as 'vague'. One student wrote, 'I think having freedom in exploring and depicting air contributed to my greater understanding of air in design' and another said, 'I liked

that we weren't all forced to present the same drawing over and over again'.[23] 71% of responses said the project introduced new ideas. 78% reported improved understanding of window openings. 37 responses to an optional, open question, that asked students what they had learned about air listed: greater awareness (12); importance of airflow (16); air's effect on a room (10); air's effect on health and wellbeing (5); how windows affect air (7); and how architects should design with air (6). The link between the location and opening type of a window and the air inside a room was discussed during the class review of drawings. One student wrote that; 'the window serving the room is not just about light from the sun but also the air and ventilation system in a room which is also very important'.[24] 11 students reported enjoying seeing the work of their peers online and in class.

DISCUSSION

The Drawings

The depiction of air in architectural drawings is unusual[25] and there are scant examples. When air does appear, it is often in the form of a single, wavy line with an arrow, representing the putative path and direction of air flow, frozen at a selected time, day, season.

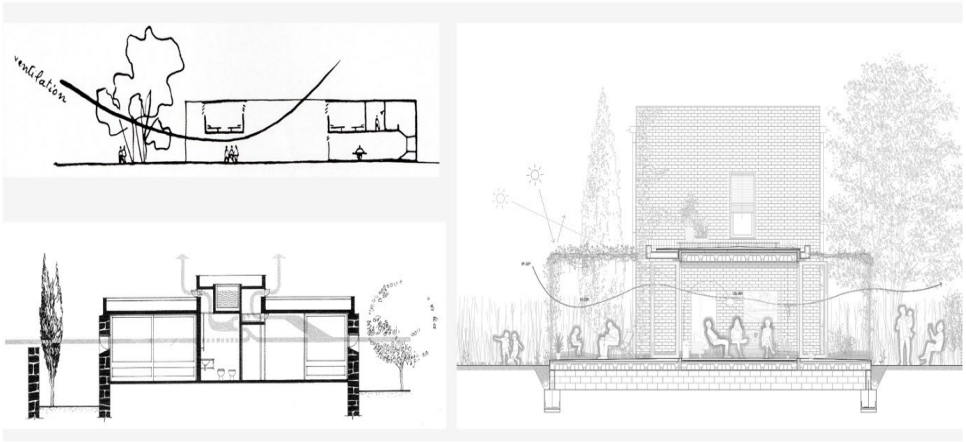


Figure 4. Drawings by Reidy + Pinheiro (1931), Decavallas (1970-2), HArquitectes (2011)

The drawings in Figure 4 show air flowing in a gentle, elegant, controlled manner, devoid of any hint of smells, sounds or storms.

Many students invented methods to represent their observations of air, methods not derived from precedents or online sources. Much of the advice available online is vague with Google AI saying that air can be represented using established conventions and symbols[26] while ChatGPT says that graphic conventions can be used to 'communicate airflow, ventilation, lightness, and spatial emptiness'.[27]

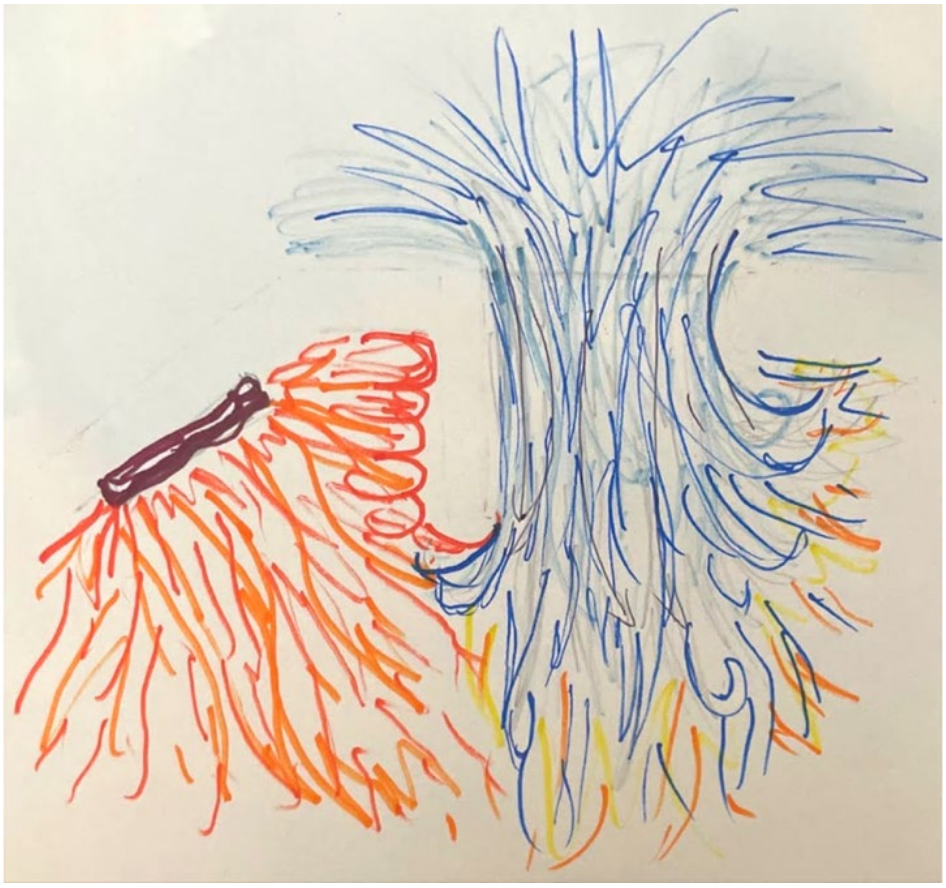


Figure 5. A plan representing air by Róisín Bailey

The student drawings bring air to life, often deploying multiple lines, whose volume, closeness, thickness, shape and colour suggest the intensity, speed, direction, and temperature of the air. In Figure 5, rapidly formed, blue-toned pen lines swoop together and appear to squeeze through an open window before their cooling molecules spread out and mix with warmer red, orange and yellow lines, projected inwards from a fireplace. The cluster of lines communicate intensity, direction, temperature and a sense of rapid change. This expressive drawing full of energy contrasts with the clean, abstract lines shown in Figure 4. The outline of the room itself is absent but apparent.

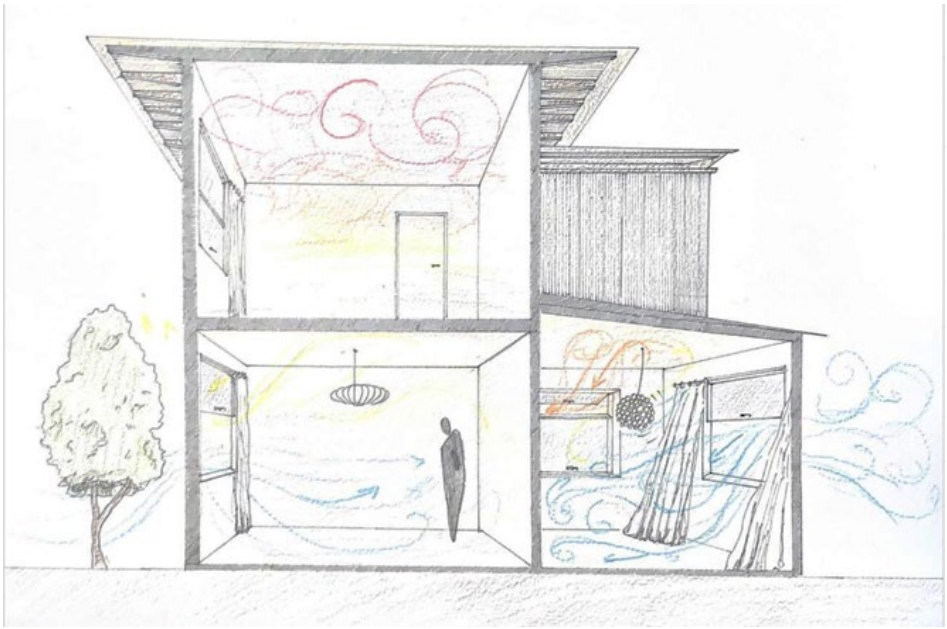


Figure 6. A sectional perspective drawing by Oleksandra Deineha

In Figure 6, swirling, coloured pencil lines show air moving through the unfurnished rooms of a house. One lonely figure stands away from a window that is sheltered by a small tree which slows and filters the air. Cool air moves gently through the window, displacing warmer air which rises upwards. The room above is warmer, heated from below, with hot air at ceiling level. The back room has windows at right angles. Cold air rushes through the lower sash of one, causing the curtains and ceiling lamp to blow inwards and currents of warm air escape through the upper sash of the adjoining window. This sectional perspective drawing not only illustrates the height and depth of each room but also represents volume and openings beyond, providing a more complete picture of airflow than is possible with a section or plan drawing. Unfortunately there is no information about occupation because that too would affect the air. This drawing demonstrates the basic mechanics of airflow in a two-storey house with dual orientation.

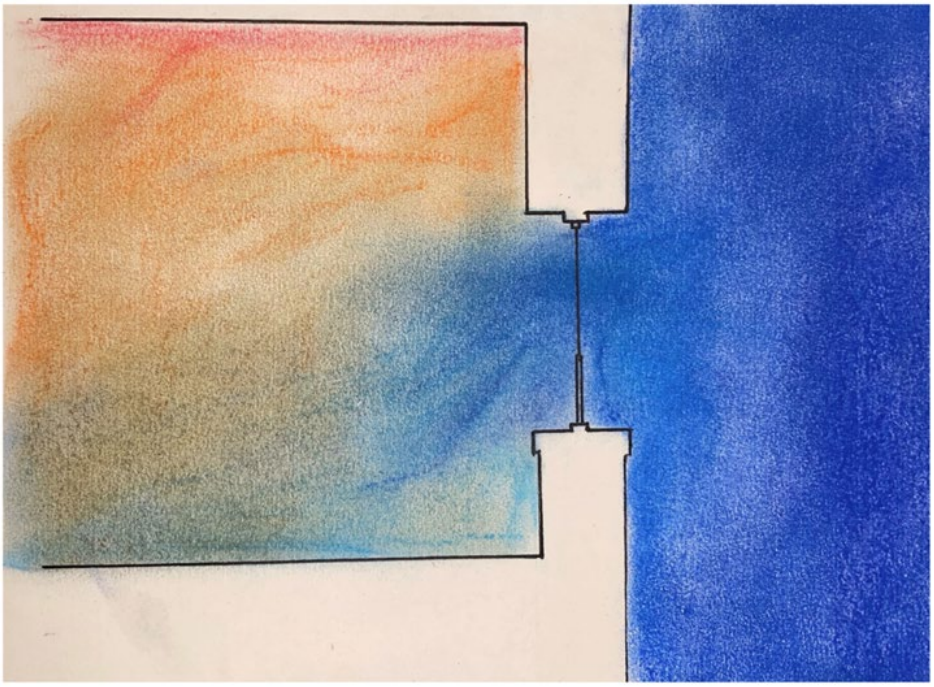


Figure 7. A section drawing showing air by Beknazar Saidov

Pencil, coloured pencil, watercolour and pastels create gradations of tone and colour in the student drawings. Chalk pastels blend seamlessly in Figure 7 representing the gradual change in temperature. The colour of air varies from deep blue coldness to warm red hues, colours long associated with temperature. Cold air sinks displacing warmer air upwards with a layer of hot air settled below the ceiling. This section drawing primarily conveys vertical movement. Section reveals the vertical dimension, plan reveals the horizontal. 4 student drawings combined section with plan or elevation to represent air in 3-dimensions. The walls, floor and ceiling of Figure 7, outlined in pen, are left empty. The room is filled with air as a physical substance rather than empty space or void. This drawing eloquently describes the continuous nature of air between outside and inside, a reminder that 'this air that is in my body was once in yours- and sooner or later, we will all breathe the same air'.[28]

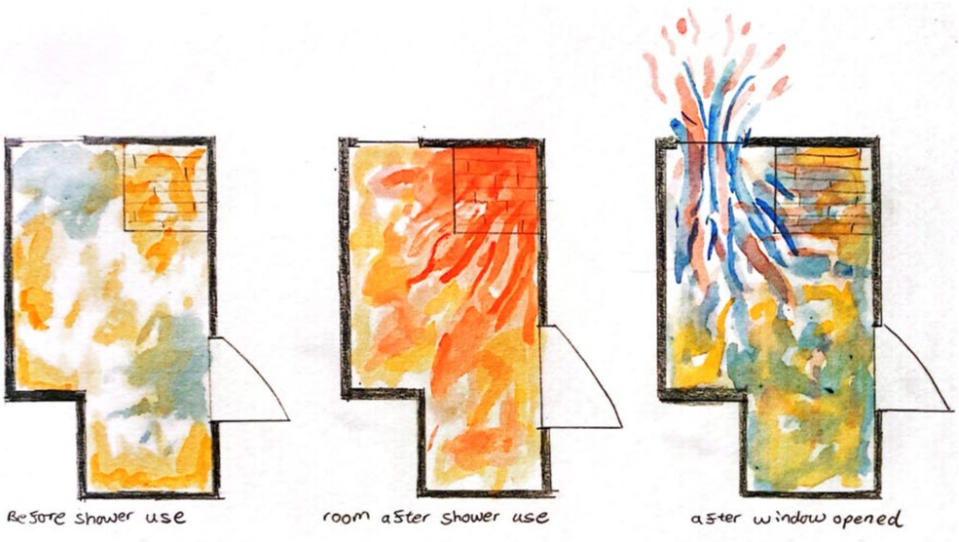


Figure 8. Plan drawings of a bathroom by James Hartnett

The dynamic, temporal nature of air is omnipresent in the student drawings. The plan drawings in Figure 8 illustrate how the bathroom air changes when the shower is used and the window opened. At first, cool air settles beside the window and door, then hot air spreads from the corner shower into the room, and finally, cold air enters through the open window while warm air and humidity escape. Watercolour brush lines communicate the volume, intensity, humidity, temperature and direction of the air. These plans demonstrate the editing that occurs naturally when drawing by hand: only the walls, door, window and shower are drawn. Extraneous information is omitted.

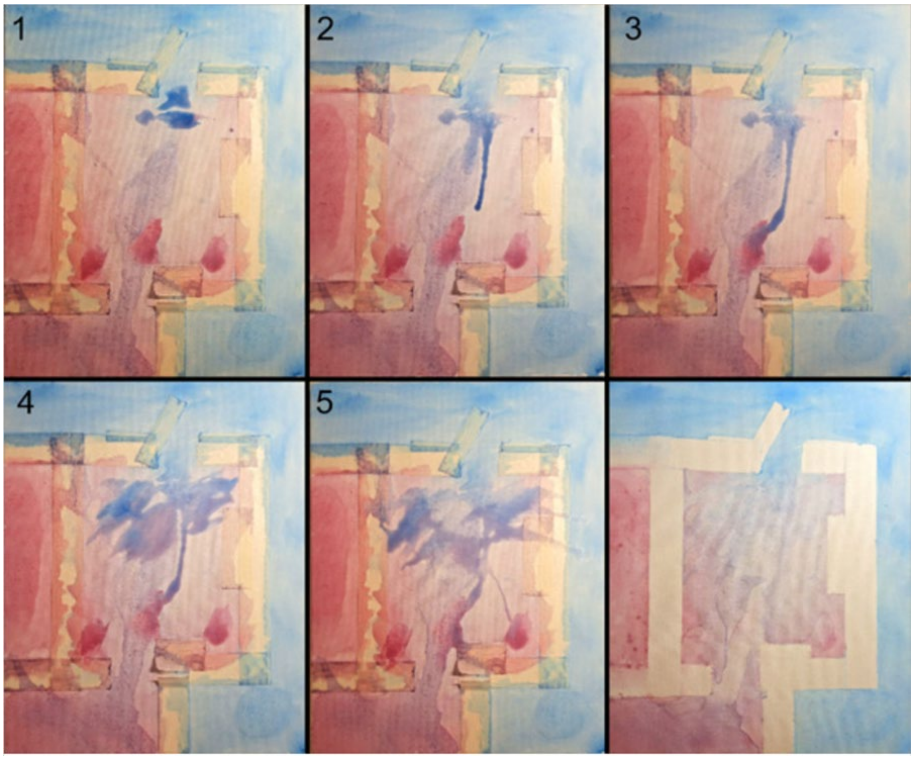


Figure 9. Plan drawings showing air by Matthew Cullen

Air behaves like a fluid. Watercolour paint is an apt choice, given that it too flows, just like air. A hairdryer was used to replicate the windblown path of cool air as it flows inside through an open window. The six photographs in Figure 9 capture the movement of air towards the door on the opposite wall. Cool, blue mixes with warmer, red creating an in-between, pale purple wash.

The student drawings with their range of themes, window type, room type, drawing type, and representation methods inform the viewer about air. Many represent more than one theme simultaneously. The drawings are multi-layered and distinct in a way that is unique to handmade work. Viewed together, they demonstrate some of the fundamental principles of airflow.

Reflection

The teaching methods utilised were novel for a technology class. The selected images, inspired by arts-based methods, opened up and expanded the conversation about air in an accessible, inclusive way. Many students took the opportunity to highlight topics of personal interest. Most pursued independent learning trajectories, evident in the variety of drawings completed.

The students experienced air in a familiar setting, and were sometimes surprised by their observations. One student wrote that ‘trying to record the movement of air around my bedroom window drew my attention to the fact that there is very little of it’. Another wrote, ‘I likes[d] that we got to examine a

window that we knew and weren't prescribed a window. It made us more cognizant of the windows were familiar with every day and how they work'.[29]

The workshop suggests that hand drawing can aid learning in a technology setting, where prescribed, measured drawings are the norm. Heretofore, air was understood quantitively, abstractly, within optimum number ranges, divorced from the ambiguous, variable, messy reality of air experienced in real life. The embodied, tactile process of drawing by hand drew attention to the sensorial perception of air. The intrinsic flexibility and malleability of hand drawing was an effective means to represent the fluctuating quantitative and qualitative aspects of the air observed. The finished drawings viewed collectively translated individual observations of air into visceral, imaginable, memorable portrayals.

The workshop demonstrated that hand drawing can facilitate exploration and learning. Hand drawing's potential to engage mind and body in active, creative, critical dialogue seems especially relevant as Artificial Intelligence sweeps into education, changing and challenging the development of independent thought and creativity.[30]

Limitations

- It is not possible to replicate teaching conditions when repeating a workshop because the students and context change.
- The output was graded, which may have restricted exploration but was also an incentive[31].
- In 2024, the in-class, after questionnaire was completed by 21 of 58 students[32] whereas in 2025, 49 of 69 students completed the questionnaire.
- The researcher's declared interest in air may have prompted students to overestimate their learning.
- The workshop occurred within a temperate climate zone.

CONCLUSION

The 'Airing Out' workshop used air as a lens to study window openings and their impact on interior environment, simultaneously raising awareness of air beyond the built environment, as part of a global ecosystem. Students observed the air at windows and rooms they knew intimately, but the workshop conversations extended to far-reaching, climate-related issues. Air as a topic has the potential to bridge between the personal and global.

The workshop demonstrated that air can reveal fresh perspectives on window design and interior environment in architectural education. Perhaps air as a lens can deepen understanding of the building envelope (be it sealed or porous). Perhaps air can inform the location of functions and rooms when designing layouts.

The workshop demonstrated that the process of hand drawing and subsequent review of drawings offer distinct learning opportunities. Following completion of the workshop, 98% of students said that they were more likely to consider air in future design work. It is not possible to gauge whether that awareness will endure and translate into design.[33] The workshop revealed the entanglement of air with place, culture, climate, with our very existence, and began to hint at the potential of air in design of the built environment. Attuning our senses to the air that surrounds us is one small step towards air inhabiting our spatial and creative imaginations.

NOTES

[1] Tonino Giffero quoted in John Stanislav Sadar, "Quasi-materials and the making of interior atmospheres," *Interiority* 1, no. 1 (2018), https://doi.org/10.7454/in.v1i1.8, https://go.exlibris.link/7WkKd7tN., pp. 54-55
[2] Jorge in conversation with Nancy Levinson and Frances Richard Otero-Pailos, "Repairing Architecture Schools," *Places Journal* (2024), https://doi.org/https://doi.org/10.22269/240314, https://placesjournal.org/article/repairing-architecture-schools/#0; Otero-Pailos, "Repairing Architecture Schools."; Otero-Pailos, "Repairing Architecture Schools."; Otero-Pailos, "Repairing Architecture Schools."
[3] World Health Organization overview of air pollution and attendant health risks. https://www.who.int/health-topics/air-pollution#tab=tab_1
[4] Sasha Engelmann, "Floating feelings: Emotion in the affective-meteorological atmosphere," *Emotion, space and society* 40 (2021), https://doi.org/10.1016/j.emospa.2021.100803, https://go.exlibris.link/dZpkLNv4.p. 2
[5] Awan et al., 2011, 46
[6] Sousa Santos, 2023
[7] O'Neill, 2015, 31
[8] O'Neill, 2015, p. 60
[9]https://hub.ucd.ie/usis/!W_HU_MENU.P_PUBLISH?p_tag=MODULE&MODULE=ARCT20100&ARCHIVE=Y&TERMCODE=202500
[10] Ben Sweeting, "Not all conversations are conversational: A Reflection on the constructivist aspects of design studio education," *Constructivist foundations* 9, no. 3 (2014), https://go.exlibris.link/QybJ4hX7.
[11] Mottram, 2007
[12] Lucas, 2016
[13] Juhani Pallasmaa, 2009
[14] UCD Student Curators, *'Social Construct' podcast*, podcast audio, digital tools - how are they being taught?2024, https://open.spotify.com/episode/01oNhtSC6NhWn3cAxPmL2N?si=93e41dec54ad445c.
[15] Neuendorf, 2002, p.1, via Sharan B. Merriam and Elizabeth J. Tisdell, *Qualitative research: a guide to design and implementation*, Fourth;4th;4; ed. (San Francisco, CA: Jossey-Bass, a Wiley brand, 2016). p. 447
[16] from Dean Hawkes, 2007
[17] Patricia Leavy, *Handbook of arts-based research* (Guilford Publications, 2017).p. 3
[18] Sharon Feeney and John Hogan, "Employing a visual representation technique to understand undergraduates' perceptions of civic engagement across countries," *Journal of international education in business* 13, no. 2 (2020), https://doi.org/10.1108/JIEB-11-2019-0049.
[19] Schön, 1995
[20] Schon, 1985, via Jones et al. 2025
[21] An orthographic projection can be defined as a method of representing three-dimensions in a two-dimensional drawing that retain dimensions, by projecting views onto parallel planes.
[22] Analysis of 'after' survey, conducted following the 'Airing Out' workshop in 2025.
[23] Student response to Question 12, 'after' questionnaire, conducted following the workshop in 2025.
[24] Student response to Question 6, 'Describe briefly what you learnt about air, if anything, through completing this project (Brief 1).'
[25] This observation is based on over three decades in the profession of architecture, two decades as an architectural educator and three years in research.
[26] https://shorturl.at/31P3C, accessed 20 January 2026.
[27] https://chatgpt.com/c/695d0e6d-8350-8325-b432-20e470858cc6, accessed 6 January 2026.
[28] Sarah Robinson, *Architecture is a Verb* (Routledge, 2021).p.96
[29] Student answer from Question 12, 'after' questionnaire, conducted following the workshop in 2025.
[30] UCD hosted an online panel on 20 January 2026 on the topic of Artificial Intelligence. Dr. Michał Wieczorek, Assistant Professor in AI-driven Educational Innovation in UCD's School of Education asserted that learning cannot be circumvented through use of AI, and there is little evidence to date that AI assists learning.
[31] Two questionnaire responses said that grading of the assignments restricted exploration. One response said that the grade allocated was an incentive.
[32] In 2024, the questionnaire was conducted in week 10 of the trimester when student attendance had fallen due to several impending deadlines. In 2025 the 'after' questionnaire was conducted in week 5.
[33] Question 8, 'after' questionnaire, 2025, asked 'Are you more likely to consider air in your studio design work, having completed the project?

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LEARNING SITES: INSTITUTIONAL BUILDING AS INSTRUCTIONAL FRAMEWORK

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INTRODUCTION: INSTITUTIONAL BUILDING AS LEARNING SITES

The discussion of architectural pedagogy is rarely tethered to the learning sites where instructional activities take place. In typical American universities, an architectural education would start with abstract formal studies and culminate in speculative projects envisioned for global cities. Within this framework, the institutional building where such an education takes place is seldom foregrounded in the curriculum sequence. However, when considered differently, institutional buildings could in fact provide prime learning sites for architecture — a discipline grounded in the entwined relationship between intangible concepts and their materialization in the physical space. In other words, through engaging with the immediate and physical environment wherein architectural learning takes place, architect-educators could invent transformative educational experiences for the next-generation designers. Institutional buildings not only provide directly perceptible spatial forms as precedents, but they also provide a generative framework through which revolutionary design pedagogies could be developed to reinforce an education grounded in environmental and social empathy. Seen in this light, it might not be a coincidence that important architectural schools have historically placed an emphasis on the creation of their institutional buildings: from Walter Gropius's Bauhaus Dessau to James Sterling's Anderson Hall at Rice University, the hidden connection between institutional buildings and their functionality as learning sites presents a potentially fertile field for scholarly research.

In this context, California Polytechnic State University (Cal Poly)'s Building 5 — home to Cal Poly's Architecture Department — provides a compelling opportunity to examine how institutional architecture can operate as an active site of learning and pedagogical engagement. Commonly known as the Architecture Building and designed by Burde, Shaw, and Associates in the 1970s, Building 5 is one amongst several Brutalist buildings constructed on campus in the second half of the twentieth century.[1] The university claimed that the style was chosen given its popularity around its time of conception, and its emphasis on raw concrete neatly negotiated budget constraints with functionality.[2] In fact, as Brutalism offered a less expensive and more rapid means of construction, it thrived on many institutional campuses in postwar America.[3] However, due to the intrinsic rigidity of concrete structures, these buildings also tend to resist easy renovations and modifications.[4]

Yet despite the typical stereotypes associated with Brutalist buildings, the Architecture Building is also characterized by an open framework — structurally and conceptually. Unlike its neighboring buildings cladded with pale yellow stucco and limestone tiles, the Architecture Building exposes its

structure hence construction logic. Bare concrete functions as both the skeleton and the shell, forming positive and negative volumes that host clusters of design studios, classrooms, administration offices, and service cores. The building's spatial organization is outright simple yet legibly functional. This straightforward treatment extends from spatial organization to material usage. Like Alison and Peter Smithson's Hunstanton School, the Architecture Building appears and is made of glass, steel, and concrete. No additional cladding or painting was applied as camouflage; and to borrow the argument formulated by Reyner Banham, one can see what the Architecture Building "is made of, and how it works, and there is not another thing to see except the play of spaces."[5] The unadorned concrete finish renders the building in blueish gray, giving it an aura which its earlier users criticized as cold, inhuman, and alienating.[6] It is in this environment, with an aim to counteract this tendency of coldness and alienation, that several pedagogical experiments are developed to prioritize hands-on experiences over digitalized imaginations.

LITERATURE REVIEW: WHAT CONSTITUTES AN INSTRUCTIONAL FRAMEWORK IN DESIGN EDUCATION

Traditionally, the learning and making of architecture is an embodied act: the learning site was tethered to the construction site, and technical knowledge was transferred through apprenticeship. With the invention of drawings as an instructional apparatus, this immediate relationship between architects, apprentices, and buildings has become increasingly tenuous and immaterialized.[7] The turn-of-the-century digital boom has further severed this relationship between designers, their training, and the physical space in which they operate. More recently, the development of generative Artificial Intelligence propels educators to reconsider what learning and creativity means in a new technologically enhanced world.

As advocates embrace digital tools that purportedly could augment design education, cautionary researchers have also noted areas these tools could not — and should not — replace. One such area is the materialized and embodied engagement with the physical environment in which learning and practicing design takes place.

Scholars have noticed that the design studio setup constitutes a "signature pedagogy" for the profession. Specifically, Lee S. Shulman observes that pedagogical approaches and the design of educational spaces reciprocally shape one another, and that the workshop configuration of design classrooms fosters a nonhierarchical mode of instruction centered on individual critique.[8] In his paper investigating studio culture and technological augmentation, Phillip Crowther briefly elaborates on the correspondence between design pedagogy and the physical space of architectural studios, noting that the informality of the studio environment supports a flexible pedagogy across the industrialized world — one in which design knowledge is transmitted through individualized feedback between academics and students.[9] Thomas Dutton describes studios as "active sites" where students are engaged intellectually and socially, with one another and with the learning environment.[10] He notices the unnerving trend of aesthetic formalism in emerging architectural education, and proposes a transformative model of pedagogy where design studios incubate socially-responsible architects-to-be.[11] Within this instructional framework, students are challenged to solve problems simulating real-life practice, hence gaining experience integrating theories with the practical aspect of world-building.[12] Nevertheless, most of the pedagogical reformation is applied to organization of curriculum contents, and emphasis on "physical engagement" is largely based on the use of analog design methods such as drafting and model-making. The architectural space where such an engagement happens is rarely of interest to design educators and pedagogical reformers. Even when physical infrastructure enters the discussion, it is typically reduced to questions of interior and furniture design within spaces that architects conventionally refer to as "studios."

This neglect of the relationship between overall school architecture and classroom practice straddles the discourse of design and education research. It is only until recently that educational researchers began to lead inquiries into the impact of school design on general education.[13] In conjuring educational facilities' influences on students, researchers investigate not only the architecture itself, but also the atmospheric and psychological conditions of the learning environment. Specifically, borrowing Robert G. Owens and Thomas C. Valesky's school climate model, Neil Gislason argues that architecture tends to facilitate educational practice if there exists a good fit between school culture, program, and building design.[14] However, studies usually focus on K-12 education and interior layouts, thus eluding the influences that institutional buildings could pose on an architectural pedagogy in higher education. When higher education is analyzed, scholarly attention typically centers on active learning in science and engineering engendered within "studio spaces" — collaborative learning spaces that are in fact long established in design education.[15] Therefore, while it is now evident that schoolhouse is one integral element that shapes the learning environment, given an architecture school's unique mission to train designers of spatial literacy, the building itself — beyond the encapsulated studios — could take a more active facilitator role than remaining a passive container.

THREE CASE STUDIES: THE ARCHITECTURE BUILDING PROMOTES EMBODIED LEARNING

With its open structural and spatial framework, the Architecture Building invites multiple modes of physical engagement. It thus cultivates a heightened awareness of perception and interaction within solid, tangible, three-dimensional space — a mode of experience that has long inspired pedagogical experimentation and remains urgently relevant in today's increasingly dematerialized world. This section will unfold in three case studies that help illuminate the building's contribution to a visionary architectural education.

Analysis through observation

In 1977, shortly after the Architecture Building opened its doors, a group of students conducted their senior project based on an in-depth analysis of the building, its architectural qualities and afforded human behaviors.[16] Through self-directed observations carried out in the built environment, the students raised their concerns about the building being rough and alienating, making it difficult for its users to leave their personal marks in a constructive way.[17] They also discovered the lack of proper furniture in the building's public space albeit the concrete steps that might provide temporary seating but were cold, firm, hence undesired.[18] Based on their observations, the students made thoughtful recommendations for improvements, imagining a warm, public space that is conducive to personalization facilitating various activities ranging from studying, reading, to eating.[19] Historically, senior projects are capstone research following the university's traditional focus on project-based learning experiences. These projects invite students to use and evaluate the knowledge and skills gained through the major curricula while demonstrating career readiness.[20] Yet unlike a typical thesis investigating more distant matters, this 1977 senior project positioned the campus building as simultaneously a research subject and an active testing ground for learning outcomes. As a result, the students' report is grounded in the physical experience of the real. Through a network of on-site observations, drawings, and photographs, their study generated immediate feedback and demonstrated the potential for tangible impact. Notably, although the digital turn has revolutionized architectural education in the twenty-first century, the students' observations from the 1970s did not become obsolete. On the contrary, their concerns have been addressed in contemporary discourse. At Cal

Poly, an ongoing pedagogical experiment is formulated to foreground the institutional building itself as an active participant in the learning process. The material immediacy afforded by the building redefines an instructional framework that could redress the bemoaned alienating effect of architecture as discovered by the students in the 1970s.

Temporary intervention

Due to the university-defined protective status of the Architecture Building, modifications are generally discouraged whilst structures that may drill into, deface, or mechanically attach to the existing building require complex permitting processes and bureaucratic negotiations. Given this constraint, the first-year studio faculty introduced a design project named "paraSITE" to the core architecture curriculum in the 2000s. It is noteworthy that this occurred shortly after Columbia University's paperless studios ushered in a wave of digitalization across architectural education. Yet, at the turn of the century, amid a rapidly transforming technological landscape, faculty at Cal Poly seemed to be stubborn about the discipline's enduring connection to the physical world and its irreducible importance in an architect's training. Hence, using the Architecture Building as a given site, students were required to design and fabricate, in small groups, light structures that can be temporarily anchored on the building to provide affordances such as seating, shading, and, of course, a personalized photographic backdrop (figure 1-2). Grounded in materialized spatial experiences, site and anthropometric considerations were amongst the foremost topics that faculty prompted students to explore. Students were guided to conceive interventions that, unlike standalone objects, could enhance the context in which they dwelled. Using tapes, frames, and fabrics, students quickly examined design concepts at their actual sites, and subsequently developed connection details that were both project-specific and demountable, hence avoiding permanent alterations on the Architecture Building itself.[21] Furthermore, projects were required to engage the human body in various manners: not only were the interventions to be installed on site through the students' physical power, but once located, the design should engage passers-by in meaningful anthropometric means.[22] Most projects were constructed using cheap as-found materials ranging from recycled lumber to paper cups, and students envisioned their design through the messiness of physical modeling and prototype making (figure 3). Planimetric drawings, due to their technical accuracy, were used as part of a permitting process, whereas a greater portion of the project was envisioned and evaluated in concrete three-dimensional forms. Echoing the building's aesthetics, final outcomes were documented through rough charcoal drawings — and specifically images seen with a human perspective. Those images defy abstract concepts and are valued by their concreteness; they are the images that can "carry the mass of tradition and association, or the energy of novelty and technology."[23] The witty name of the paraSITE project plays with a doubled meaning. On one hand, engaging with an existing building structure and working alongside its inherent materiality is the most straightforward way of introducing site considerations to beginner designers. The immediacy of the building that contains the working suites allows students to study contexts in the most direct manner. On the other hand, the light structures designed and fabricated by the students are intrinsically parasitic: their very existence cannot come into being without the existing concrete edifice affording somewhat of a structural support. Temporarily attached to the Architecture Building while using its structure as as-found material, these projects allowed students to tangibly investigate interplays amongst materials, contexts, and the human scale.[24] These are contingencies that are commonly omitted from foundational design curriculums. Yet they are the very elements that make architecture a humane discourse. In deviating from the canonical formal abstraction deeply imprinted in the architectural pedagogy, these student projects, in exploring frankly the correlations between site, material, structure, and the human body, defied the idea of an

irresponsible architectural autonomy. They advocated for an architectural education grounded in site-specific learning and constructable interventions that sustain a balance between conceptual inquiry and material practice. If representation offers one avenue for bridging theory and practice, this paper argues that repositioning institutional buildings as active learning sites can further strengthen that connection while simultaneously generating spatial benefits, for the school and beyond.[25]

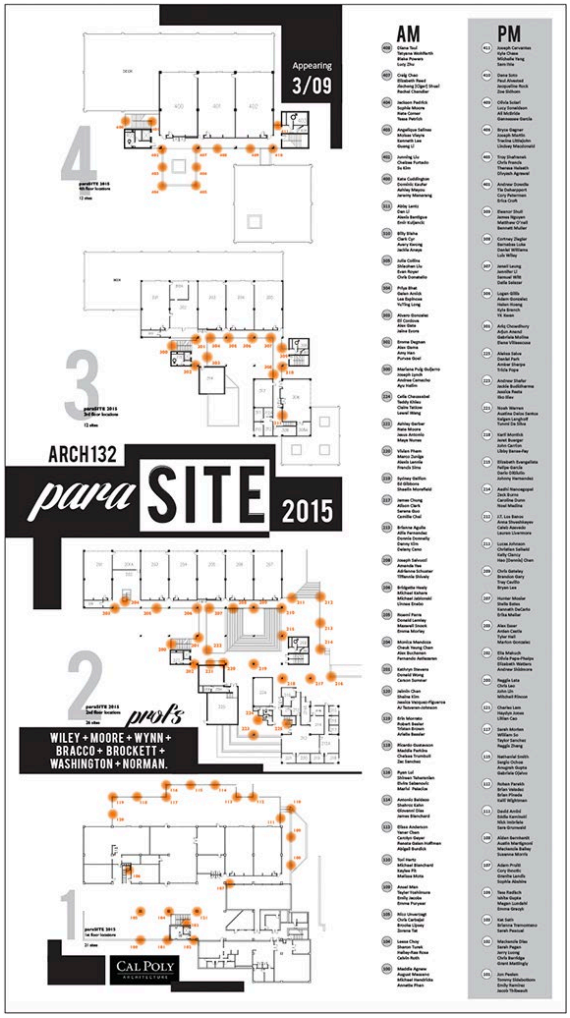


Figure 1. Assignment poster, ParaSITE 2015. Courtesy of Humberto Norman.



Figure 2. Work by Dan Li, Abby Lentz, Emir Kuljancic, Alexis Bantigue for ParaSITE 15. Courtesy of Humberto Norman.

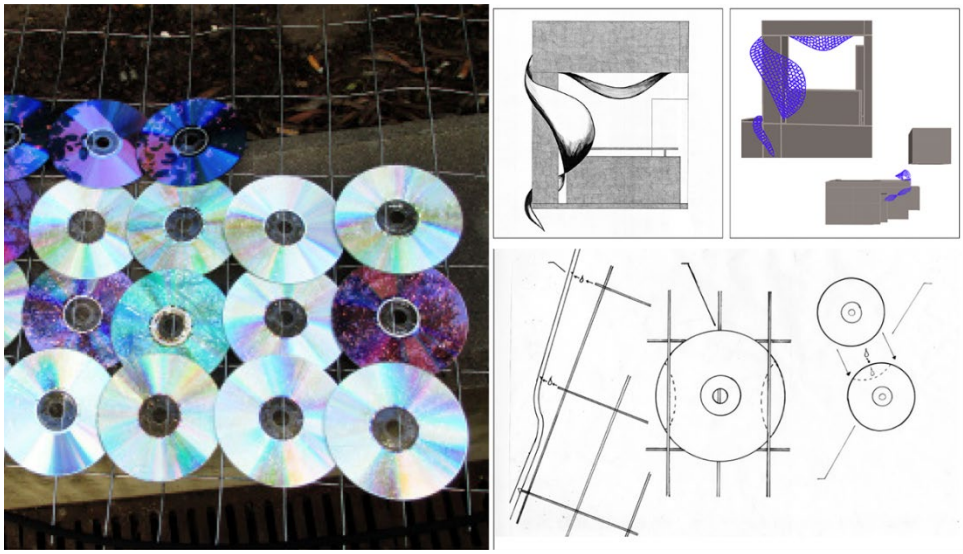


Figure 3. Work by Jordan Cadman, Isabeau Guglielmo, Nick Horaney, and Robin Johnston for ParaSITE 14. Courtesy of Humberto Norman.

Long-term coexistence

"Parasite" is about symbiosis. The name signifies what the add-ons are supposed to do: thriving together with its host through maintaining a balance of contact. At times, this symbiosis extends beyond structural mutuality to engender a reciprocity between instructional activities and public services. Similarly parasitic yet built for durability, recent elective studios by Professor Jonathan Reich focus on creating benches that lightly intervene underutilized sites on campus — including ones in the Architecture Building — to create space for socializing (figure 4).[26] The projects are partially inspired by public furniture made by Parisian guerrilla activists, who worked nocturnally to fabricate discarded scraps into useful pieces of seats and tables.[27] Conceived as small community infrastructure built from as-found materials and impromptu onsite construction that reveals ad hoc structural innovations, these furniture pieces illuminate an alternative approach to making architecture. Architecture here is not synonymous for grand mansions or Gothic cathedrals, but small yet functional

installations that activate public space for public use. In this context, architecture is repositioned as constructions that provide a built framework conducive to a cooperative social life.[28]



Figure 4. Consilio Hanging Bench, photograph by the author.

Within the Architecture Building's spatial boundary, benches designed and made by students in Reich's studio hung from the top ridges of existing concrete walls. The existing concrete structure, over-engineered for their original usage, provides stable support. The benches hence rely on the building structure to function yet thrive to stand with minimum contact. The design configuration conforms with the building's geometry while improving the building for community gatherings. It provides functional surfaces for sitting, studying, eating, and napping — programs that the student researchers from the 1970s advocated for. The act of hanging not only allows the add-on furniture to remain adjustable — since no permanent fixation is required — but also enables the student-designers to circumvent complex permitting procedures and potential conflicts with university administration. This strategy of suspension operates through a search for equilibrium within a dialectical relationship, fostering the development of site-specific structural details. The anchorages, fabricated with hardware, hot dipped galvanized steel, or occasionally wood studs, cables, steel straps, and trussed brackets, elegantly interface with the existing building walls and columns, adapting to their various dimensions (figure 5).[29] All structural supports are plainly exposed, so are the multi-purpose surfaces made from reclaimed wood or locally sourced composite materials. Their materiality, whether new or old, rusty or moldy, is honestly expressed. Designed to be partially prefabricated and partially constructed onsite, the benches were made and assembled by students, hence affording an unusual and rewarding learning experience.[30] Beyond the design concept itself, they prompted the consideration of site, budget, code, material selection, along with other environmental and human factors in and beyond the design process. By treating campus buildings as immediate sites of intervention, the project rendered visible the otherwise unseen domains of architectural production, ranging from environmental impacts and labor conditions to post-occupancy usage.[31] The Architecture Building as a locus for design education thus becomes a living laboratory. One might argue that the redwood finish of the benches, standing in stark contrast to the cold concrete, imparted warmth to the "cold"

building once criticized by the student researchers in the 1970s. Yet it is more accurate to suggest that liveliness emerged from the carefully resolved interaction between the two structures, a dialogue that directly responded to the earlier call for public space articulated in the senior project decades prior. Moreover, conceived as furniture-cum-sculpture and fabricated as part of a pedagogical experiment, the benches redefined the reciprocal relationship between architecture and affordances, theory and practice, students and designers. This symbiotic relationship, sustained by the building as an instructional framework, may embody a new means of learning and producing architecture that is worth the exploration of generations of architectural practitioners, engineers, and educators.



Figure 5. Hanging connection details for various benches, photograph by the author.

CONCLUSION

Through three case studies centering on pedagogical experiments that led to built structures within campus buildings, this paper proposes that by repositioning institutional buildings as active learning sites, an instructional framework could be developed to reinforce students' understanding of architecture as a site-specific, material practice. Yet this is not to deny the influences of digital tools — established or emerging — on architectural education. Retrospectively, visionary pedagogical shifts have followed important technological advancements to update systems of knowledge production on par with transforming logic in professional practices. This happened at the paperless studio at Columbia University. This also happened at the Bauhaus more than a century ago. Digital technologies might bring about new efficiency tools or novel conceptual structures that could strongly influence architectural thinking.[32] However, it should not contest the profession's foundational connection with the physical world. Therefore, this paper serves to remind educators of the ready availability of such a connection in the everyday educational setting, and to provide some teaching models that may also be awaiting their updates in the digital age. More importantly, this update might be reciprocal — since if there is one frontier of machine learning that generative AI is yet to master, it is the perception and conception of embodied, spatial experience in the concrete, physical world.

NOTES

[1] Jeff Ashby Powell, Jan Edwards, and Carl Schneider, “Architecture Building, Cal Poly, SLO,” Senior Project, 1977: page G-H. Accessed via Robert E. Kennedy Library’s archive.
[2] “Building Cal Poly, 1902-2022,” Cal Poly Robert E. Kennedy Library, accessed March 19, 2025, https://guides.lib.calpoly.edu/CPHistory/buildingcalpoly#:~:text=Construction%20of%20the%20Science%20Building,of%20campus%2C%20is%20also%20visible.
[3] Angela Person and Ty Cole, *Capital Brutalism: A survey of Past, Present and Future Brutalist Architecture in the Nation’s Capital* (Washington DC: National Building Museum, 2024), 7. Examples of Brutalist buildings could be found on campuses of Georgetown University, Yale University, amongst many more.
[4] Person and Cole, *Capital Brutalism,* 7.
[5] Peter Reyner Banham, “The New Brutalism,” *A Critic Writes: Selected Essays by Reyner Banham*, (eds.) Mary Banham, Paul Barker, Sutherland Lyall, Cedric Price (Berkeley, Los Angeles, London: University of California Press, 1996), 10. Original essay published in *The Architectural Review* 118 (December 1955): 354-361.
[6] See, Powell, et.al., “Architecture Building, Cal Poly, SLO,” Senior Project, 1977.
[7] See, Mario Carpo, *The Alphabet and the Algorithm* (Cambridge, MA: MIT Press, 2011).
[8] Lee S. Shulman, “Signature Pedagogies in the Professions,” *Daedalus* 134, no. 3, *On Professions & Professionals* (Summer 2005): 52–59.
[9] Phillip Crowther, “Understanding the signature pedagogy of the design studio and the opportunities for its technological enhancement,” *Journal of Learning Design* 6, no. 3 (2013): 18-28.
[10] Thomas A. Dutton, “Design and Studio Pedagogy,” *Journal of Architectural Education* 41, no.1 (1987): 16–25.
[11] Dutton, “Design and Studio Pedagogy,” 16-25.
[12] Crowther, “Understanding the signature pedagogy,” 18–28.
[13] Neil Gislason, “Architectural design and the learning environment: A framework for school design research,” *Learning Environments Research* 13, no.2 (2010): 127–145.
[14] Gislason, “Architectural design and the learning environment,” 128-131. See also, Robert G. Owens and Thomas C. Valesky, *Organizational behavior in education: Adaptive leadership and school reform* (9th ed.) (Toronto, Canada: Pearson Education, Inc., 2007).
[15] Summer Smith Taylor, “Effects of Studio Space on Teaching and Learning: Preliminary Findings from Two Case Studies,” *Innovative Higher Education* 33 (2009): 217-228. See also, Crowther, “Understanding the signature pedagogy,” 19.
[16] See, Powell, et.al., “Architecture Building, Cal Poly, SLO.” Senior Project, 1977.
[17] Powell, et.al., “Architecture Building, Cal Poly, SLO.” Senior Project, 1977: R9.
[18] Powell, et.al., “Architecture Building, Cal Poly, SLO.” Senior Project, 1977: R15.
[19] Powell, et.al., “Architecture Building, Cal Poly, SLO.” Senior Project, 1977: R15.
[20] “Senior Project,” Cal Poly Academic Programs and Planning, accessed October 26, 2025. https://academicprograms.calpoly.edu/content/academicpolicies/Policies-Undergrad/Senior-project.
[21] Keith Wiley et.al., *ARCH 132 paraSITE assignment brief* (California Polytechnic State University, San Luis Obispo: 2015). Courtesy of Humberto Norman.
[22] Keith Wiley et.al., *ARCH 132 paraSITE assignment brief*.
[23] Peter Reyner Banham, “This is Tomorrow Exhibit,” *Architectural Review* 120, no.716 (September 1956): 188. Quoted in Anthony Vidler, *Histories of the Immediate Present* (Cambridge, MA: MIT Press, 2008), 137.
[24] “paraSITE project,” Student Work Exhibitions, accessed March 19, 2025. https://architecture.calpoly.edu/current/exhibitions/paraSITE. Similar language is used in Keith Wiley et.al., *ARCH 132 Studio Syllabus* (California Polytechnic State University, San Luis Obispo: 2016): 1-4. The introduction of human-centered perspective alongside the paraSITE project is evidenced in Keith Wiley, Emily White, et.al., *ARCH 132 Studio Syllabus* (California Polytechnic State University, San Luis Obispo: 2017): 6.
[25] Diana Agrest, “Representation as articulation between theory and practice,” postscript to *Practice: Architecture, Technique, and Representation*, by Stan Allen (G+B Arts International, 2000), 163-178.
[26] Iterations of the same studio have also explored other types of interventions that build a dialectic relationship with the Architecture Building. Those projects range from small furniture and pavilion structures to large concept housing that infills the building’s existing rooftop terraces. All those projects focus on fostering a sense of community through building with the existing environment. Studio and project details learned from email exchanged with Jonathan Reich (March 2025).

[27] Information obtained via email exchanged with Jonathan Reich. For a brief introduction of Parisian guerrilla benches, see https://layylaovertherooftopsoftheworld.wordpress.com/2014/03/19/public-furniture-by-guerrilla-activists/.

[28] This is also explicitly framed by course syllabus developed by Jonathan Reich. In the fall 2016 version of ARCH 451 studio syllabus, a quote from Philip Thiel talking about architecture's environmental and social affordances is highlighted. See, Philip Thiel, *Visual Awareness and Design* (Seattle: University of Washington Press, 1981).

[29] Not to mention that by hanging on the wall, the benches leave open the ground plane, which can be more easily accessed and cleaned by campus custodians.

[30] "Hanging Bench," project Introduction, courtesy of Janathan Reich and California Polytechnic State University, San Luis Obispo. See also, Sandy Stannard, "Discere Faciendo: Teaching and Learning Through Making" (paper presented at the ACSA108 Virtual Conference, June 15-19, 2020).

[31] The benches not only give credits to the student designers and laborers involved, but also to the material sources: the redwood used in one of the designs is sourced from a nearby ranch, whose forest and mill the students have visited. Studio and project details learned from email exchanged with Jonathan Reich (March 2025).

[32] Rivka Oxman, "Digital design thinking: in the new design is the new pedagogy." *CAADRIA proceedings* (2006): 38–40. See also, John Latto, "Exploring an Evolving Architectural Pedagogy in the Age of Digital Creativity and Artificial Intelligence: Examining the Challenges to Critical Thinking," in *Creativity in the Age of Digital Reproduction*, eds. Giancarlo Di Marco, et al. (Springer Nature Singapore: 2024), 118-127.

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RETHINKING ARCHITECTURAL EDUCATION: WHY DESIGN-BUILD MATTERS AND HOW TO MAKE IT WORK

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INTRODUCTION

This contribution is based on the realisation that the future of people depends on the future of the planet, and that this entails an urgent change of course in how we deal with our environment and the organisms that use it. A transition is needed, from a human-centred and growth-oriented approach towards an eco-centred mode of thinking and acting, taking into account the planetary boundaries. In its publication 'Reimagining our futures together, a new social contract for education,' UNESCO[1] emphasises the vital role of education in rebuilding our relationships with each other, with the planet and with technology. Future-focused educational institutions must immerse students in varied hands-on learning environments and guide them in collaborating with diverse actors across disciplines. In this context, experiential, practice-based pedagogical approaches are increasingly coming to the fore again. This contribution aims to highlight the value of *design-build* as an example of such an approach in architectural education. Starting from an analysis of five *design-build* initiatives taking place at the KU Leuven Faculty of Architecture (Ghent & Brussels, Belgium), we are reflecting on the advantages and challenges of this approach. Based on this, we are making recommendations on how higher education institutions can make this work.

BACKGROUND AND CONTEXT

Like other Higher Education Institutions, architecture schools need to prepare young professionals to act in a contemporary context that is highly volatile, uncertain, complex, and ambiguous. Yet many educational systems still operate from individualistic, mind-centric learning paradigms, limiting students' transformative capacities to address complex 21st-century challenges.[2]

Scharmer and Kaufer[3] argue that learning environments should be reorganized to enable learners to rethink societal systems. Co-creation is forwarded by these authors as one of the seven core practices for educators who want to help students develop these capacities. They are describing this as: '*designing learning experiences that allow for exploring the future by doing - through prototyping and experimentation.*' In architectural design education, the attention is, in this context, turned back to hands-on learning methods, such as *design-build*.

Such approaches are not new. Black Mountain College (founded in 1933 in North Carolina) and Rural Studio (founded at Auburn University in 1993) are two archetypal examples of architectural learning environments rooted in Dewey's 'experiential education'[4] and Freire's 'critical pedagogy'.[5] Yet since

the beginning of the 21st century - particularly in the wake of the Bologna Agreement - architecture schools have increasingly been expected to articulate their theoretical underpinnings more explicitly while simultaneously developing research-oriented practices. Institutions that transitioned from university-college traditions into university structures have faced the challenge of integrating diverse knowledge domains that intersect within architectural inquiry, ranging from the arts to engineering and the social sciences. In this landscape, hands-on approaches such as *design-build* can become vulnerable to scrutiny, precisely because they operate across and beyond conventional academic formats.

Academically, *design-build* demands that its theoretical foundations are made explicit and that institutions create legitimacy and support for hybrid teaching–research formats, including the flexibility to collaborate beyond established disciplinary and administrative boundaries. As a research approach, *design-build* needs an explicit epistemic positioning: articulating what kinds of knowledge it produces, how interdisciplinary contributions are integrated, and how such knowledge can be documented and communicated alongside more conventional research outputs. With this contribution, we want to demonstrate the multiple advantages of *design-build* pedagogies and, as such, argue why these should be more prominently featured and better supported in architecture programs.

METHODOLOGY

This contribution is based on the analysis of five *design-build* initiatives taking place at the KU Leuven Faculty of Architecture (Ghent & Brussels, Belgium). These cases were examined through two co-creative reflection workshops and a collective analysis using a framework built around examination of the stakeholders involved, objectives, implementation (scale, location, materials, support, aftercare), and timeframe of the initiatives.

Based on this, conclusions and recommendations were formulated, tailored to our own institution, which we believe can potentially be scaled up to other institutions.

PRESENTATION OF THE CASE STUDIES

The KU Leuven Faculty of Architecture is a higher education institution with campuses in Ghent and Brussels (Belgium). We are a former university college that integrated into the Catholic University of Leuven in 2012/2013. Our faculty offers four different courses: a Bachelor's and Master's Degree in Architecture, a Bachelor's and Master's Degree in Interior Architecture, a Master's Degree in Urbanism & Spatial Planning, and an Educational Master's Degree in Design Sciences.

Crafting Clay (Erasmus+ project), workshop Liechtenstein

The first case is a *design-build* workshop that took place in 2025, in Liechtenstein and which was co-organised by Laurens Luyten from KU Leuven Faculty of Architecture, in collaboration with tutors from the University of Liechtenstein, the Academie van de Bouwkunst from Amsterdam, and the Norwegian University of Science and Technology (Figure 1). The workshop brought together international students and experts in wood construction and loam building, including local forest rangers, carpenters, and loam specialists from Martin Rauch's company.

As part of the Erasmus+ Crafting Clay project - which explores loam as a local, ecological construction material and teaches related techniques across four partner universities - the seven international KU Leuven master's students, together with peers from the participating institutions, learned by doing. Engaging directly with contemporary knowledge and technologies, they collaboratively designed and built a new outdoor bar for the University of Liechtenstein, while experiencing first-hand how interdisciplinary cooperation can advance sustainable construction with wood and loam.



Figure 1. Impressions Crafting Clay design-build initiative.

Shipyard Studio

The second case involves a series of *design-build* workshops for master's students in architecture, taking place since 2021 until today, which are organised by Carl Bourgeois & Annemie Demeulemeester from the KU Leuven Faculty of Architecture and are making use of the facilities of Carron shipyard (from Zelzate) (Figure 2).

The aim of these workshops is to set up a barge (canal boat) for a socio-cultural programme. The studio is part of an 'Academic Design Office' called 'NO-GRID'. Academic Design Offices (ADO) was a program funded by our faculty with the aim of strengthening the link between and the integration of education, practice and research. The ADO 'NO-GRID' aimed at developing different design approaches through temporary and nomadic 'architectural vehicles'.[6]



Figure 2. Impressions Shipyard Studio design-build initiative.

Adapt, on Continuity in Building

The third case is a *design-build* workshop with interior architecture students organised by KU Leuven FA tutors Ignaas Back, Tom Callebaut, Klaas Vanslembrouck, and Hilde Bouchez; in collaboration with the local community and local contractors from Kathmandu, Nepal (Figure 3).

This workshop involved the co-construction of a school, which took place in the context of the 'Adapt, Continuity in Building' project, which was aimed at combining traditional knowledge, crafts, and (vernacular) building techniques with contemporary approaches on the architectural as well as on a pedagogical level.



Figure 3. Impressions Adapt, on Continuity in Building design-build initiative.

Doelland

The fourth case involves a series of *design-build* workshops that were part of several bachelor's & master's design studios organised at the Faculty of Architecture of the KU Leuven, from 2016 until today, by tutors Joris Van Reusel, Daan De Volder, and Pascal François.

In the context of these studios, tutors and students from our faculty started to work together with the local community of the village of Doel, to together imagine and build a different future for this village, as a form of resistance against its disappearance, as a result of the planned expansion of the Port of Antwerp (Figure 4). Ultimately, the tutors' and students' on-site involvement contributed to the decision to 'spare' the village in 2018.[7] Since then, the work on the terrain continues, involving, amongst others, emergency renovations of some of the villages' buildings.



Figure 4. Impressions Doelland design-build initiative.

Solidary Mobile Housing

The fifth case includes a series of *design-build* workshops organised at the KU Leuven Faculty of Architecture by Aurelie De Smet, from 2017 to today, in collaboration with two social organisations (SAAMO and CAW Brussels, a group of homeless people) and several other partners from the BCR. And, until 2022, also in collaboration with Prof. Burak Pak.

These workshops are aimed at involving architecture students in the different stages of the Solidary Mobile Housing project,[8] a Living Lab funded by the BCR, in which the development of a method and a prototype for the co-creation of modular housing on urban waiting spaces, with and for homeless people and the surrounding neighbourhood are researched and tested (Figure 5).



Figure 5. Impressions Solidary Mobile Housing design-build initiative.

FINDINGS AND RECOMMENDATIONS

In this section, we are discussing the multiple advantages our analysis of these five *design-build* initiatives revealed. However, we are also highlighting the challenges that came to light and linking those to recommendations on how academic institutions can better accommodate this teaching mode.

Advantages

Firstly, *design-build* of course provides students with their first construction site experience which allows them to develop associated skills, such as creating implementation plans, planning the construction process, and responding to unforeseen circumstances. Moreover, this can also provide them with a better understanding of the relationship between design/design research and construction/realization, or between thinking and doing. In the end, this allows students to think differently in the design phase and thus design differently, as such enriching their design capacities.

Secondly, *design-build* also allows for the development of a different set of skills. This includes, academic skills, such as technical knowledge of manufacturing methods and a better understanding of material properties. But also, professional and interpersonal skills, such as collaboration, communication, and organisation (also across sectors and/or disciplines). And finally, in case the *design-build* experience involves activities abroad or including international participants, it can also allow for the development of intercultural skills.

A third advantage is that *design-build* can offer a captivating and varied learning environment and give participants a sense of purpose as they feel they are doing valuable work which will last longer and/or really make a difference for someone. This can ultimately lead to an increased motivation for students to learn and engage in their courses more actively.

Finally, *design-build* offers numerous opportunities for peer learning between students, with the tutors, and with the other involved parties. On the one hand, this allows for the validation of the personal background and prior trajectories of students and can also offer room for the recognition of the professional practice many architectural education tutors are developing next to their academic career. As a result, participants get to build stronger relationships and grow their networks, which can lead to an increase in their own social capital. On the other hand, this can also lead to the creation of new, interdisciplinary knowledge, which highlights the value of hands-on pedagogical work as a form of action research.

Challenges

Regarding the challenges, we firstly found that *design-build* requires finding a balance between the time and efforts spent on designing/researching and the time and efforts spent on building/delivery of the actual result. This means organisers need to, at the same time, provide enough space for experimentation, failure, restarting, and taking a completely different approach, while also keeping in mind the feasibility of the realisation of the final output. As a result, for tutors wanting to engage in *design-build* planning carefully and well in advance is necessary, as well as being open to adaptations along the way.

Secondly, the case analysis confirmed that *design-build* requires a lot of organisational work (both beforehand, during, and even afterwards) because, in addition to the construction itself, one also must arrange everything surrounding this, such as the provision of materials and tools, the obtainment of construction or other permits, the organisation of catering, etc... In this context, we noticed that it is essential that the faculty support services are involved and on board. Institutions wanting to engage in *design-build* thus need to develop a supportive and facilitating institutional culture and routines for this.

A third challenge we identified is that this pedagogical approach necessitates sufficient space within the curriculum. Carrying out a *design-build* project from start to finish is very difficult in one semester. Sometimes, even one academic year is not enough, as the 'real' and the academic worlds have very different rhythms. Continuity across semesters/years is therefore necessary, which entails more work, because a course integrating *design-build* might need to be organised differently each semester/year. Institutions wanting to integrate *design-build* in their curriculum thus need to carefully consider the balance and division of time between theory and practice.

A fourth challenge our analysis revealed is a lack of appreciation for BD (and other hands-on activities) in the academic context. As mentioned in the introduction, the importance of the transfer of implicit knowledge, process-oriented approaches (versus a focus on final results), and alternative outcomes (such as students' personal development) is often undervalued in academia. Institutions wanting to engage in *design-build* thus need to put in place alternative ways to validate this kind of - less traditional - output.

A fifth observation, related to the previous one, is that - as in *design-build,* much more emphasis lies on the process - this approach requires specific guidance methods. In this context, participants need to be facilitated to collaborate as a group, which can be done by providing a clear framework, using an open communication style, establishing transparent consultation and decision-making structures and helping students to define and divide roles and tasks. Moreover, attention also needs to be paid to group dynamics, for example, by also enabling less-dominant students to participate, intervening in time when interpersonal conflicts may arise, and eventually supporting the development of a 'group spirit' through social activities. Additionally, students (and tutors) need to learn how to deal with unforeseen circumstances, which, for example, requires building in flexibility and paying attention to upholding motivation even in times of setbacks. Finally, evaluating *design-build* activities also requires a distinct approach, which may involve collectively determining evaluation criteria, monitoring/making the learning process explicit (through observation, documentation, reflection, and dialogue), and using self- and peer assessment. Tutors who want to engage in *design-build* thus need to get acquainted with these pedagogical methods, which might require the institution to provide professionalisation initiatives for this.

Finally, there are, of course, also legal and financial hurdles; as, in the context of *design-build*, increased attention is needed to safeguarding safety and health, mitigating risks, and protecting copy- and property rights. Institutions wanting to engage in *design-build* thus need to set up clear and adequate frameworks for this, which must be supported on all levels of the institution.

CONCLUSION

Our analysis showed how - as illustrated in Figure 6 - the *design-build* approach finds itself at the crossroad between education, practice/engagement and research. Which is its strength, but because of this, it also - literally and figuratively - exceeds the boundaries of traditional academic approaches.

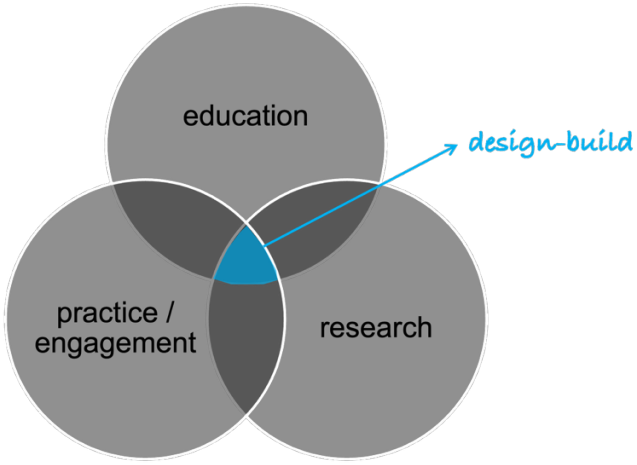


Figure 1. Positioning of design-build:
at the crossroad between education, practice/engagement and research.

Accommodating the *design-build* pedagogy, therefore, requires a dismantling of the proverbial 'ivory tower'. To do so, universities must, on the one hand, open themselves to the world, for example, by (1) validating alternative forms of output and (2) creating space for this kind of activities in the curriculum. However, on the other hand, they must also actively invest and engage themselves in the outside world, for example, by (1) adopting a different culture and routines, (2) developing clear, adequate and widely supported frameworks to facilitate this approach, and (3) putting in place initiatives to support the professionalisation of tutors who want to engage in such activities.
However, if they manage to do so, students, the institution itself and the other involved parties will be strengthened, because - as our analysis also shows - *design-build* approaches can lead to enhanced design processes, better collaborations, and innovative knowledge production, which are necessary to support the transition towards eco-centred mode of thinking and acting, taking into account the planetary boundaries.

NOTES

[1] UNESCO, *Reimagining our futures together: a new social contract for education* (Paris: UNESCO, 2021).
[2] Fiona Patrick, "Review article: Neoliberalism, the knowledge economy, and the learner: Challenging the inevitability of the commodified self as an outcome of education", *International Scholarly Research Notices Educatio*n, 4 (2013), accessed January 16, https://doi.org/10.1155/2013/108705; Jonathan J. B. Mijs, "The unfulfillable promise of meritocracy: Three lessons and their implications for justice in education," *Social Justice Research*, 29 (2016): 1, accessed January 16, 2026, https://doi.org/10.1007/s11211-014-0228-0; Jonathan J. B. Mijs, "The unfulfillable promise of meritocracy: Three lessons and their implications for justice in education," *Social Justice Research*, 29 (2016): 1, accessed January 16, 2026, https://doi.org/10.1007/s11211-014-0228-0.
[3] Otto Scharmer and Katrin Kaufer, *Leading from the Emerging Future: From Ego-System to Eco-System Economies* (San Francisco: Barrett-Koehler Publisher, Inc., 2013); Otto Scharmer and Katrin Kaufer, *Presencing: 7 Practices For Transforming Self, Society, And Business* (Oakland: Barrett-Koehler Publisher, Inc., 2025)
[4] John Dewey, *Democracy and Education: An Introduction to the Philosophy of Education* (New York: Macmillan, 1916); John Dewey, *Experience and Education* (New York: Macmillan, 1938).
[5] Paulo Freire, *Pedagogy of the Oppressed* (New York, Continuum, 1970).
[6] https://www.blog-archkuleuven.be/no-gird-shipyard-24-25/?filter_department=28; Aurelie De Smet, Maristela do Nascimento Rocha, Kathia Reynders, Ward Foulon, Victor Goossens, Leon Hardeman, and Mariam Tharwat, *Levers as a pre-condition for integral education: An exploration of principles and transformative mechanisms of Service-learning in the case of Doelland*. (Brusssels: KU Leuven Faculty of Architecture, 2025)
[7] Aurelie De Smet, Maristela do Nascimento Rocha, Kathia Reynders, Ward Foulon, Victor Goossens, Leon Hardeman, and Mariam Tharwat, *Levers as a pre-condition for integral education: An exploration of principles and transformative mechanisms of Service-learning in the case of Doelland*. (Brusssels: KU Leuven Faculty of Architecture, 2025)
[8] https://solidhomes.be

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EXPLORING LOW-FIDELITY TOOLS FOR EMBODIED LEARNING IN THE ARCHITECTURAL STUDIO

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INTRODUCTION

In contemporary architectural education, students increasingly design in digital environments—scaleless, infinitely zoomable spaces in which minute details can be obsessively refined yet remain imperceptible when plotted on paper or encountered at the scale of the body.[1] As digital modeling software becomes more prevalent, handcrafted physical models and representational practices are often dismissed as inefficient, costly, or time-consuming, contributing to a diminished understanding of scale and embodied spatial experience.[2] Even when human figures, furniture, or other reference objects are embedded in digital models, students frequently struggle to grasp the extent, proportion, and experiential qualities of the speculative spaces they propose.[3]

Research and pedagogical observations suggest that when comparative analysis is established between digital representations and physical elements—especially at full scale and within familiar spatial contexts—students develop a more grounded understanding of the physical and psychological implications of their design decisions.[4] This raises a central pedagogical question: what strategies can architectural education employ to establish meaningful comparisons between representation and inhabitation, and to reintroduce bodily experience as a core instrument for understanding scale?

Embodied Learning in Design Education

Embodied learning is a pedagogical approach that integrates physical interaction with learning materials to enhance understanding and engagement.[5] It requires multisensory engagement, primarily going beyond just the visual and incorporating proprioception or an awareness of one's body in space.[6] In architectural education, specifically within the design studio, embodied learning is the primary way scale is introduced—how students perceive the size of architectural elements, enclosures, and environments in relation to the body and to other spatial conditions.[7] Understanding scale in architecture requires not only careful observation, but also relational comparison.[8] Students throughout their education and professional careers are constantly adding to their personal catalog of compelling (and not compelling) spaces as they experience buildings, structures, and sequences within the built environment. Measuring and annotating dimensions – height, width, depth, length - help to capture the extents of a space or elements within a space, but scale ties directly to sensorial experience. How can we begin to understand the feelings a space evokes throughout the design process? Which representational and experiential tools most effectively convey a sense of scale to the contemporary architecture student?

Contemporary Challenges for Embodied Pedagogy

At the beginning of their design education, students commonly struggle to understand scale—particularly the translation between drawn or modeled representations and full-scale, inhabitable space—a gap that architectural pedagogy has repeatedly identified as a core challenge of early studio learning.[9] Physical models and architectural drawings—plans, sections, and axonometric views—traditionally support this understanding by communicating speculative ideas to a known architectural scale, even when those representations are not constructed one-to-one. With the introduction of digital modeling, students can generate perspectival images and simulate inhabitation and movement within a project. While these tools offer new representational possibilities, they also risk obscuring an understanding of scale. Digital models operate within a largely scaleless environment unless references such as bodies, furnishings, or contextual structures are deliberately introduced.[10] As drawings are increasingly extracted from digital models rather than constructed through iterative representations, students may devote disproportionate attention to perfecting the digital model itself, treating it as the project rather than as a tool for testing spatial ideas across multiple scales and for evaluating how spaces are proportioned, occupied, and experienced.[11]

This tendency to prioritize digital tools is reinforced by material and temporal constraints within contemporary studio culture. The cost of physical modeling materials and the time required to construct them often discourage students from experimenting with this medium across multiple representational scales.[12] In response, students frequently rely on 3D printing for rapid prototyping or on rendered images to convey experiential qualities. While effective for certain forms of testing, 3D-printed models are typically too small to articulate interior conditions, and renderings often simulate particular views without requiring sustained engagement with scale, structure, or bodily movement.[13] When a single digital tool is asked to simultaneously describe form, experience, and inhabitation, students' capacity to evaluate their designs across plan, section, and spatial sequence is diminished.

Historically, architectural education has addressed these challenges by situating questions of scale within the studio environment itself. School buildings often act as pedagogical instruments—familiar spaces of known dimensions that serve as base comparisons for speculative design work.[14] Early Beaux-Arts schools filled their studios with one-to-one plaster casts, using bodily proximity and material presence to study scale, proportion, and ornament. Contemporary architecture schools continue this tradition by exaggerating, exposing, or annotating architectural elements, encouraging constant scalar comparison as students conceptualize new projects. The Yale Art and Architecture Building exemplifies this approach, embedding plaster casts within its Brutalist interior and in doing so collapsing representation and inhabitation into a single pedagogical space.[15]

In the post-pandemic studio environment, however, sustained engagement with these shared, physically instructive spaces has become increasingly difficult. While students may attend studio courses in person, much of their design work now takes place at home and in isolation, where space and access to physical modeling tools are limited.[16] Under these conditions, digital models and small-scale 3D prints have become dominant modes of exploration, particularly where institutions provide free or subsidized printing. Yet these tools struggle to replace the embodied understanding of scale that emerges through direct, bodily engagement with full-scale drawings and annotated spaces. This gap suggests the need for representational strategies that are inexpensive, spatially adaptable, and capable of translating architectural drawings directly into inhabitable experience—allowing students to occupy, measure, and compare aspects of their designs at full scale.

Embodied Learning in the Architectural Profession

Architectural offices, like academic design studios, test spatial ideas at multiple scales and across varied media. The key difference is that professional workflows are billable and therefore driven by fee and risk: firms push early, low-fidelity prototyping to explore design questions cost-effectively, then escalate to high-fidelity mock-ups during pre-construction and construction phases. While high-fidelity mock-ups emphasize material assemblies and performance, low-fidelity mock-ups focus on spatial qualities and scalar relationships.[17]

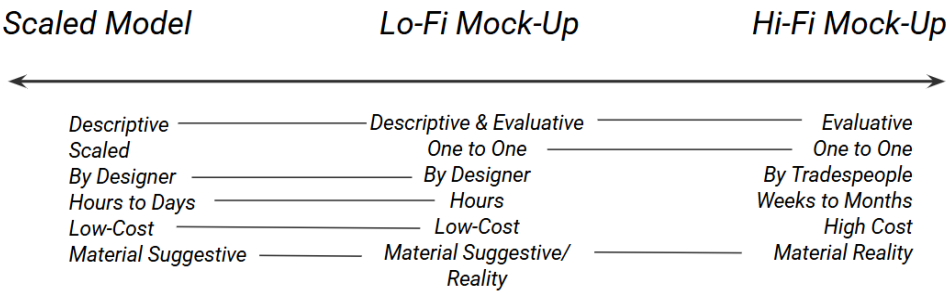
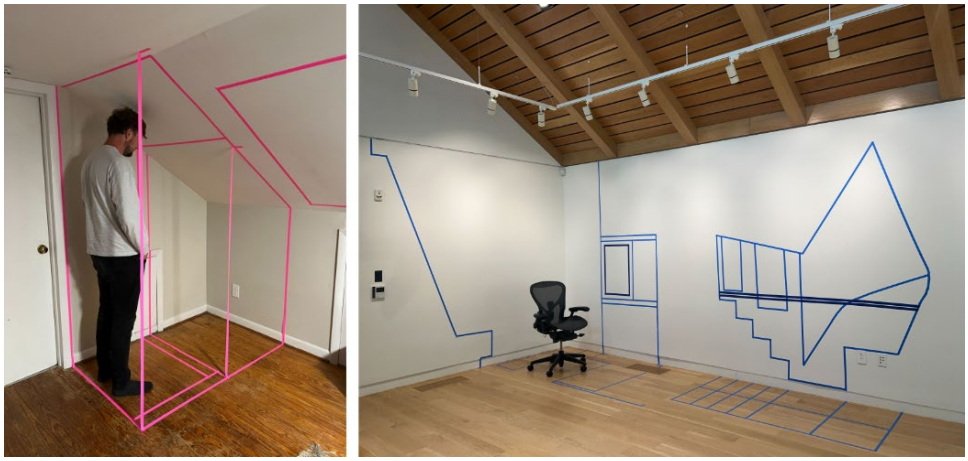


Figure 1. Comparison of Physical Design Tools

This approach mirrors UX and Interaction Design practice, where low-fidelity prototypes (i.e. paper sketches, clay models, wireframes) are used to test ideas quickly, collect feedback, and avoid premature refinement. Once the iterative prototypes are evaluated, only promising options proceed to the high-fidelity mock-up phase.[18] Standard UX guidance defines low-fi prototypes as simple, early representations used to validate concepts rapidly and cheaply, precisely to reduce later rework—a logic architects share when they prototype with cardboard, foam, tape, or even natural materials (Figure 2-4) in the studio or on site. [19]



Figures 2-4. Images of low-fidelity mock-ups by Vardehaugen Architecture using tape and snow[20]



Figures 5-6. Low-fidelity tape mockups of architectural proposals (left) and of case study projects. Photos and tape constructions by the author on site (left) and while at Loghaven Artist Residency.

These low-fidelity mock-ups allow designers to assess spatial ideas quickly and affordably in the early stages of the design process. When brought into the academic studio setting, their effectiveness is heightened by direct engagement with the physical environment and by proximity to peers' evolving work, fostering constant comparison, feedback, and iteration.

Testing Low-Fidelity Tools in the Architectural Studio

In the fall 2025 iteration of the advanced research studio: *Restorative Space*, students worked extensively with low-fidelity mock-ups to understand specific moments within selected case study projects and eventually to evaluate moments within their own design proposals. The research conducted within the studio focused on analyzing and designing environments that mitigate emotional and psychophysiological stress, replenish attentional resources, and regulate overstimulated minds and bodies. The studio enrolled twelve students—six undergraduate Bachelor of Science students and six Master of Architecture students—who were asked to test restorative design strategies across varying scales and contexts. In doing so, students investigated not only spatial form, materiality, and composition, but also the emotional, cognitive, and sensory dimensions of architectural experience. Central learning objectives included deepening students' understanding of scale and bodily engagement with the built environment, while broadening conceptions of comfort and accessibility and the ways perception and sensation inform architectural design.

Methodology

Where previous studios typically begin with site analysis and proceed downward in scale toward the design of a building, this studio inverted that sequence. Students began by designing and analyzing a specific moment within a project and then translated the formal, spatial, and material logic of that moment outward to inform the larger architectural proposal. Working in groups, students examined case study projects through a combination of analytical diagrams, physical models at ½" = 1'-0" scale, and—most critically—full-scale low-fidelity mock-ups (primarily section and plan drawings) constructed with 1" painter's tape of varying colors. These one-to-one mock-ups were produced along a shared studio wall, overlapping over time to form a palimpsest of architectural moments.

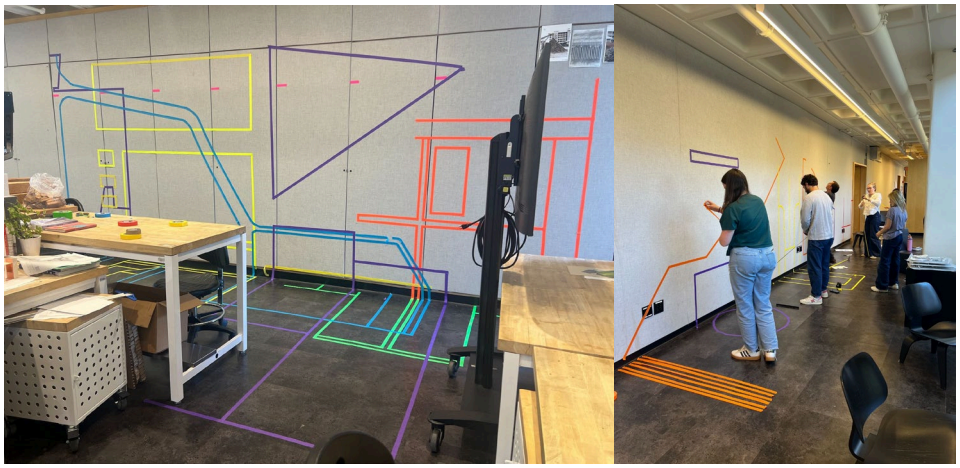


Figure 7-8. Low-fidelity tape tests within the studio space. Constructions often occurred simultaneously, with overlap due to space constraints. Photos by Author.



Figure 9. "Tape Scape" of Moments within Design Proposals. Photo by Author.

This accumulating "tape scape" enabled students to project spatial relationships directly onto the surrounding walls and floors of the studio, creating distilled, quasi-inhabitable representations of key moments from their case studies. The act of taping required students to move, measure, and occupy space, recalibrating their sense of scale through bodily engagement rather than purely visual observation. In contrast to digital models or small-scale physical artifacts, these full-scale, low-fidelity mock-ups recalibrated students' sense of space through direct encounter, reinforcing the studio space itself as a pedagogical instrument for understanding scale.

Why Low-Fidelity Matters

Like low-fidelity prototypes in other design fields, these tape-based constructions prioritize speed, ease of adaptation, and spatial testing over graphic refinement. The provisional, reversible qualities of the medium relieved pressure on students to produce visually perfect representations, shifting attention instead toward the feeling, proportion, and experiential scale of space while encouraging iteration, collective adjustment, and critical discussion. Through this hybrid representational mode, students were prompted to consider how design decisions register at the scale of the body—through

thickness, adjacency, sightlines, and movement—rather than solely through visual composition and representations.

This method offers a low-cost, spatially flexible alternative for exploring formal, spatial, and material strategies. By translating architectural ideas directly into quasi-inhabitable mock-ups, the tape constructions bridge the gap between abstraction and experience, reinforcing the role of full-scale, low-fidelity prototyping as a critical pedagogical tool within contemporary architectural education.

CONCLUSION

This paper argues that while contemporary architectural education benefits from the power and precision of digital modeling, the dominance of one design tool risks displacing students' embodied understanding of space. The studio method presented here—full-scale, low-fidelity "tape scapes"—offers a pragmatic, accessible means of moving between mediums and design tools to test spatial ideas. By relocating questions of scale to the body and to the surrounding environment, low-fidelity mock-ups transform the studio itself into an instrument of measure: a backdrop where spatial decisions are tested through movement, reach, and sequence rather than through scaled architectural representations alone.

Pedagogically, the value of low-fidelity lies in its imperfection and looseness. The low-stakes, reversible nature of tape invites experimentation, redistributes attention from graphic legibility to perceived experience, and invites iterative and collective authorship. In practice, this approach resonates with established professional workflows—full-scale mock-ups for assemblies and spatial testing—and with cross-disciplinary design cultures that use low-fidelity prototypes to test assumptions early and often. The "tape scape" reframes these precedents for the academic studio: preserving what is most valuable (experiential evaluation at scale) while removing barriers of cost, time, and labor.

More broadly, the method advances key aims of the *Restorative Space* studio by enabling students to engage questions of comfort, accessibility, and cognitive/emotional experience at the scale of the body from the outset, rather than treating them as post-render considerations. By overlapping one-to-one plan and section logics in a shared palimpsest, students learn to navigate multiple scales simultaneously—detail, room, sequence—while situating their design proposals within the familiar dimensions of the studio environment. In doing so, they develop a comparative sensibility: how a certain scale of space feels, how adjacency functions, and how thickness and transitions are read and experienced.

Reintroducing scale as embodied knowledge does not diminish the value of digital representation; it anchors it. When students move between inhabitable drawings and virtual models, they learn to design across media and measures—aligning what is drawn, what is built, and what is felt. As a pedagogical tool, the "tape scape" bridges the divide between digital abstraction and physical experience. It cultivates designers who are better equipped to adapt to existing environments and shape new ones with empathy, precision, and care—grounding design in the lived realities of human scale.

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CARESPACES: RETHINKING WORKSPACES FROM A CARE PERSPECTIVE

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INTRODUCTION

The diffusion of remote work, once a marginal practice, has – since the pandemic – become an increasingly entrenched feature of everyday life for many people, compelling institutions, professionals, and families to rethink spatial configurations and the temporal dynamics associated with them. Within this context, this paper seeks to explore a new dimension of work spaces by interweaving them with the concept of care. Specifically, the contribution draws on a design-based research experience aimed at investigating the transformation of the ground floors of two existing buildings – one in Milan and the other in Cagliari (Italy) – into "Carespaces": new shared environments embedded at the neighbourhood scale, designed to address emerging needs related to care, work, and social interaction.

THE ESCAPES PROJECT

This study is conducted within the framework of the PRIN2022 national research project "ESCAPES – Experimental Spatial Solutions for the Sustainable Management of Remote Work and Family Care", funded by the European Union (Next Generation EU, National Recovery and Resilience Plan). The project is jointly developed by three research units representing complementary disciplinary fields: Architecture (Politecnico di Milano), Family Sociology (University of Cagliari), and Labour Law (University of Milan). The research is grounded in an interdisciplinary approach that brings these fields into systematic dialogue, with the objective of analysing the socio-spatial implications of the growing diffusion of remote work.[1] In particular, the project examines how remote work is reshaping everyday environments – ranging from domestic spaces to workplaces and urban contexts – and reconfiguring social relations, including those involving family members (with or without children), older adults, friends, and non-human companions. The pandemic functioned as a critical turning point, bringing to light both the potential and the structural weaknesses of a work model centred on the dematerialisation of the office. On the one hand, this shift has resulted in the downsizing of conventional office environments and a growing demand for temporal and spatial flexibility. On the other, it has exacerbated unequal distributions of care responsibilities, which continue to be borne – largely without formal recognition – by women, single parents, and newly emerging caregivers.

Emerging Spaces for Remote Work

A first line of reflection concerns the transformation of work spaces. The pervasive diffusion of digital technologies has profoundly reshaped everyday life, giving rise to what has been described as an "onlife condition,"[2] in which physical and digital dimensions are increasingly intertwined. While this condition has been widely discussed in relation to social practices, its implications for work spaces remain comparatively underexplored. The traditional workplace – defined by stable physical locations, fixed schedules, and clearly delimited tasks – is progressively losing its centrality. Contemporary work spaces are instead becoming multiple and dispersed: they extend into domestic environments, permeate urban settings, and are increasingly concentrated within personal digital devices, which now function as fully fledged mobile offices. Against this backdrop, a critical question emerges: what spaces are suitable for remote work today? In the post-pandemic context, marked by the widespread adoption of smart working practices, identifying alternative sites for work beyond the conventional office has become a pressing concern. These sites encompass a hybrid constellation of settings, ranging from home-based workspaces to a variety of New Working Spaces (NeWSps),[3] such as coworking spaces, fab labs, and makerspaces, which are typically grounded in principles of collaboration, sharing, and social exchange. However, the analysis highlights a significant gap in current approaches: limited attention has been paid to how work environments outside the traditional office might also respond to personal and everyday life needs, particularly those related to care. This critical observation informed the development of the "Carespaces" workshop, conceived as an exploratory design exercise. The workshop provided a framework for reflecting on and investigating the interconnections between architecture, work, and care, with specific attention to their social, urban, and labour-related dimensions within a contemporary context increasingly shaped by remote working practices.

WORK-CARE SPACES

Students were asked to design "Work-Care Spaces," namely environments that integrate work-related activities with care functions in order to support workers' well-being. The empirical material collected throughout the project revealed a growing interest in spaces that incorporate care and wellness-oriented services, including nurseries, after-school facilities, shared kitchens for meal preparation, laundries, home-based healthcare services, spaces dedicated to yoga and physical activity, and forms of assistance for older adults.

The concept of care was explored through key theoretical references and subsequently reframed in relation to architectural practice. On the one hand, the project proposes an interpretation of care in relation to the physical activation of space, understood as a catalyst for positive dynamics within the neighbourhood – what has been described as "design as an act of care."[4] On the other hand, it seeks to restore a sense of publicness to regenerated spaces by framing care as a collective and community-based practice, capable of reintroducing social and relational value into the urban environment.[5] In this perspective, care emerges as the guiding thread that connects architectural intervention and social action, contributing to the construction of a more inclusive city oriented towards people's well-being. Architectural design is no longer conceived as the generator of a static space, interpreted as fixed, timeless, and immutable. Rather, it is understood as a dynamic spatial condition that unfolds in relation to the temporal dimension of everyday life.[6] This shift marks a departure from traditional approaches centred on the production of definitive and permanent spaces, towards a more fluid and adaptive perspective.

The "Carespaces" Workshop

Held in February 2025, the "Carespaces" workshop brought together students from the Politecnico di Milano – namely from the School of Architecture, Urban Planning and Construction Engineering and the School of Design – and from the Faculty of Architecture at the University of Cagliari. The workshop was conceived as an exploratory framework to examine the potential transformation of the ground floors of two existing buildings, one in Milan and one in Cagliari, both sharing a similar spatial typology rooted in the tradition of the nineteenth-century urban gallery. Within the workshop, these buildings were examined as instances of urban interiors that, while historically connected to the legacy of passages, are currently subject to processes of functional redefinition and spatial reconfiguration. Both case studies are characterised by high architectural quality and are based on an explicit integration between architectural form and the surrounding urban fabric. The Ormus Galleries in Cagliari, designed by Giulio Minoletti between 1963 and 1967, were conceived as part of the city's post-war expansion and aimed at accommodating the needs and aspirations of the emerging middle class. Likewise, the building in Milan – designed by Mario Asnago and Claudio Vender in 1959 in the Bande Nere district – was developed within a broader programme of urban growth. Despite these shared premises, the two cases reveal divergent evolutionary paths. In Cagliari, the gallery, originally envisioned as a vibrant urban interior, has never fully realised its intended function and remains characterised by an indeterminate use, leaving the space in a condition of persistent ambiguity. In Milan, by contrast, the spatial dynamics are more heterogeneous: while the units facing the adjacent public square continue to be actively used, those opening onto the gallery are largely unoccupied, exposing a clear inconsistency in patterns of use and spatial experience. In this perspective, the gallery should be understood not only as an architectural element, but as a socio-relational space shaped by tensions and uncertainties, where the interaction between the city and its inhabitants is continuously redefined and takes on new spatial configurations.

THE DESIGN EXPERIENCE OF THE ORMUS GALLERIES

Among the two buildings investigated within the workshop, this contribution focuses on the Ormus Galleries, a complex of five buildings designed by architect Giulio Minoletti (1910-1981) and constructed between 1963 and 1967 in the San Benedetto district of Cagliari (Italy). The site belongs to the city's first post-war expansion areas and underwent significant redevelopment processes around the early 2000s. The architectural complex consists of residential towers arranged in a comb-like configuration and set upon a shared, double-height base forming a public "plinth" devoted to offices, commercial activities, and food services. Rather than being conceived as a compact and enclosed block, this base functions as a porous element, articulated through two courtyards and three galleries that cut across it, connecting the streets surrounding the site. The search for permeability and transparency is further expressed through large domed skylights that filter natural light into the galleries, punctuating and animating the internal circulation.

Despite the architect's initial intention to create a lively and attractive hub within a growing neighbourhood, over time the Ormus Galleries have become a neglected and deteriorated space marked by abandonment and lack of maintenance. The few sporadic attempts at re-signification have taken the form of spontaneous appropriations of space by young people from the neighbourhood, often met with resistance from residents. This condition of uncertainty and suspension has represented the main design challenge addressed during the workshop.

The intervention area focused on a portion of the ground floor characterised by the central courtyard and crossed by the three galleries, as well as on the roof level of the base. The workshop explored possible operations capable of fully reactivating the plinth as a public infrastructure.

Following an on-site survey and an initial ethnographic investigation conducted with the support of the sociology research unit of ESCAPES Project,[7] the students – working in groups – carried out an urban analysis by mapping the activities present in the neighbourhood and their temporal patterns of use. Based on this investigation, they developed a functional programme aimed at fostering dialogue between the Ormus Galleries and the surrounding urban fabric. Each group spatially interpreted its own idea of a "Work-Care Spaces," adopting a design strategy oriented towards achieving a balance between private life and professional activity.

Five Spatial Strategies for Work-Care Spaces

The project "Strale" – as illustrated in Figure 1 – aimed to reactivate the Ormus Galleries through the introduction of work and care spaces that engage with the imposing presence of the nearby Teatro Lirico. Accordingly, the site's primary vocation is artistic, framing "care" as a form of cultural and recreational engagement for both adults and children. The core of the project is a multifunctional "modern amphitheatre" overlooking the theatre square, which establishes a dominant east-west axis. This axis is further reinforced by two "enfilades" of spaces: to the north, a wider sequence dedicated to shared leisure activities – such as an open-air cinema, urban gardens, a bistro with a collective kitchen, and the amphitheatre itself; to the south, a band of more formalised functions including a nursery, a coworking space, and a dance hall. The aim is to transform the space not only into a workplace, but also into a place of encounter and social interaction for the neighbourhood community.



Figure 1. "Strale" project carried out by the students: Francesca Bosis, Zixian Fang, Silvia Milone, Ilaria Nieddu, Francesca Pozzi

"Lanterna urbana" is a project that sought to reconfigure the space in order to turn it into an attractive hub capable of welcoming a diverse user base, including children and young people as well as adults and the elderly (Figure 2). To achieve this, the design strategy focused on maximising the permeability of the plinth: large, openable glazed walls establish a continuous relationship between the interior spaces and the galleries. Functionally, the project distinguishes between work-related and care-related spheres, assigning the former to spaces that visually project towards the street, and reserving more internal and sheltered areas for the latter. Accordingly, the central spine hosts a coworking space accompanied by a public garden and a café that also extends to the upper level, while more secluded areas accommodate a laundry, a facility providing home-based healthcare services, and, side by side, a nursery and a communal room for the elderly, both sharing an external green courtyard. The underlying idea is to create a place where care is understood as an opportunity for intergenerational exchange.

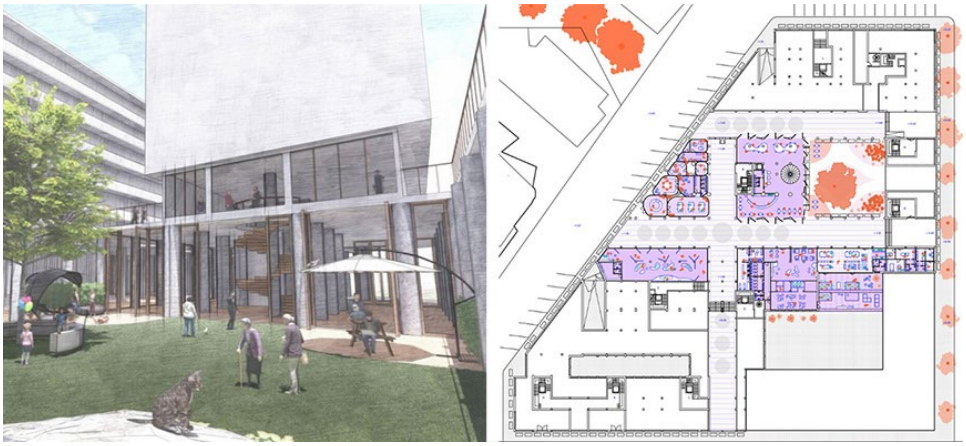


Figure 2. "Lanterna urbana" project carried out by the students: Irene Arango, Lucrezia Bonaiti, Virginia Bottolo, Alireza Khorasani, Beatrice Sanna.

The design concept of "Giardino introflesso" is rooted in a series of compositional operations involving the reconfiguration and translation of volumes at ground level, with the aim of activating and enlivening movement through the galleries (Figure 3). This approach leads to a redefinition of circulation paths, privileging the east-west axis and dividing the north-south passage into two segments, effectively “forcing” circulation through the garden courtyard, which becomes the heart of the project. Overlooking this space is a bar and refreshment area that also extends to the upper “plinth level” and connects directly to a public coworking space at the rear. The project also introduces an informal workspace for the residents of the Ormus buildings, placed in sequence alongside a series of cubic volumes of varying sizes that host different care-related services: a nursery with after-school activities, a laundry, a healthcare facility, a social concierge, and a communal room for elderly.

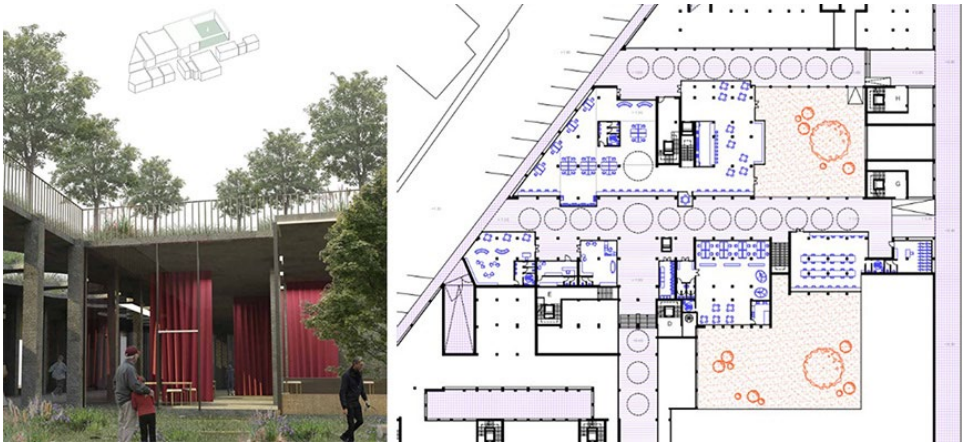


Figure 3. "Giardino introflesso" project carried out by the students: Carlo Borghesi, Elizaveta Fomicheva, Roadhàn Mckenna, Martina Pecorari, Giacomo Spanin.

With "Trame" the project deliberately performs a "tabula rasa" of the existing spatial and distributive layout, modifying the dimensions of the galleries by, in some areas, absorbing them into interior spaces and, in others, expanding them to incorporate collective functions (Figure 4). The key theme lies in the multiple interpretations of the threshold space between inside and outside, public and private, within a plan conceived as a mutable theatrical scenography. Each environment remains connected and continuous with adjacent spaces yet can be reconfigured and compartmentalised when necessary. At the core of the layout is a coworking space around which a series of support functions

for workers are organised: a bar and restaurant space opening onto the gallery; rehearsal rooms and workshops directly connected to the adjacent Teatro Lirico, envisioned both for theatre artists and for after-school activities for the workers' children.

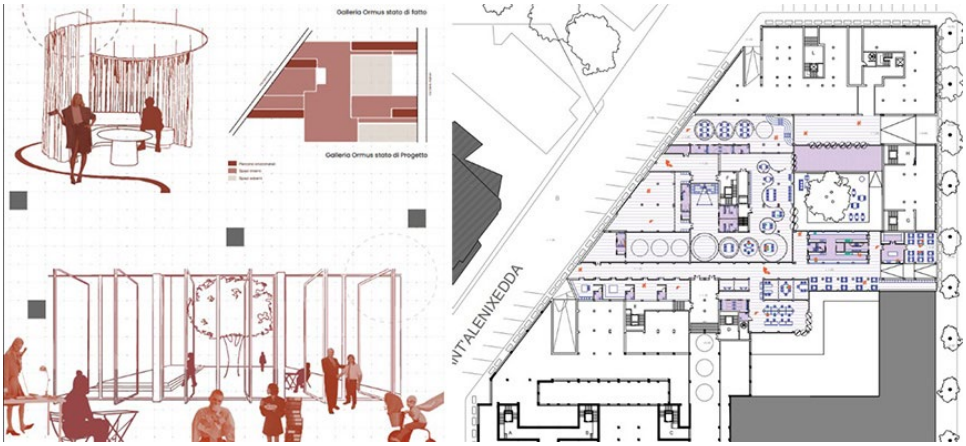


Figure 4. "Trame" project carried out by the students: Maria Cuccu, Marta Marangoni, Alessandra Marcialis, Perla Nasrallah, Arianna Simonetti, Irene Taborri.

Inspired by the defining architectural element of the galleries, the skylights, the final project, "Oculus," adopts the same circular form as a device to disrupt the orthogonal grid of the galleries and to create a central square conceived as a place of encounter and dialogue among the various activities arranged along its perimeter (Figure 5). This square is imagined as a multifunctional space, structured by the existing column grid, suitable not only for social interaction but also for performances and exhibitions. The axes of the galleries crossing the square generate four distinct functional zones: to the south-east, a work-oriented area directly connected to a baby space for working parents, both opening onto an internal green courtyard used as a playground and family reunion space; the south-west corner hosts services primarily intended for residents, such as a locker room, concierge, and self-service laundry; in the north-west area, care is interpreted in terms of physical wellbeing through the introduction of a gym; finally, the north-east corner is dedicated to a bar conceived as a community gathering space, with the possibility of expansion into the internal garden.



Figure 5. "Oculus" project carried out by the students: Maria Bologna, Heloise Paillard, Diana Tortolato, Nicola Vargiu, Alessandra Zappa.

CONCLUSION

Despite their differences, all five projects converge around a shared objective: transforming the “Minolettian” plinth into a public hinge capable of reconnecting the residential towers with the surrounding neighbourhood. The galleries, once inert and degraded corridors, are reimagined as relational infrastructures: "Strale" adds an amphitheatre as their terminal; "Lanterna urbana" dissolves their boundaries through extensive glazing; "Giardino introflesso" introduces a green courtyard that diverts circulation and generates new connections; "Trame" incorporates portions of the galleries to create flexible spatial scenarios; "Oculus" employs the galleries as cardo and decumanus, inserting a central square at their intersection.

Along this shared trajectory of permeability, the overarching aim was to reduce the everyday gap between productive and reproductive spheres by offering services that simplify care-related activities. Each group experimented with design strategies grounded in proximity concept: coworking spaces adjacent to nurseries and baby areas; laundries, concierges, and locker rooms clustered to alleviate domestic tasks; spaces for the elderly located near healthcare services; bistros and collective kitchens extending work breaks into moments of social interaction, often paired with green spaces and urban gardens.

From a spatial perspective, movable and transparent partitions, together with volumes arranged in enfilades, enable a blending of productive time and care time. The result is a shared programmatic framework that, through the aggregation of interconnected micro-spaces, restores continuity to the historic galleries and transforms the plinth into a permeable, flexible, and intergenerational civic device. Through these perspectives, the Ormus Galleries emerge as a laboratory of everyday social innovation, capable of fostering self-managed collective practices and neighbourhood-based micro-economies.

ACKNOWLEDGEMENT

This paper is the result of a collaborative reflection by the two authors. The paragraphs "Introduction", "The ESCAPES project" and "Work-Care Spaces" were written by Michela Bassanelli. The paragraphs "The Design Experiences of the Ormus Galleries" and "Conclusion” was authored by Carola D’Ambros.

NOTES

[1] Michela Bassanelli, Imma Forino and Marco Mareggi, eds., *Work-Care Spaces. Gli spazi del lavoro a distanza in una prospettiva di cura* (Siracusa: LetteraVentidue, 2025), 7.
[2] Luciano Floridi, ed., *The Online Manifesto. Being Human in a Hyperconnected Era* (New York Dordrecht London: Springer, 2015), 7-13.
[3] Ilaria Mariotti, Elisabete Tomaz, Grzegorz Micek and Carles Méndez-Ortega, eds., *Evolution of New Working Spaces: Changing Nature and Geographies* (Cham: Springer, 2024), 1-3.
[4] Annalisa Marinelli, *Etica della cura e del progetto* (Napoli: Liguori, 2002), 49.
[5] Joan Tronto, *Moral Boundaries. A Political Argument for an Ethic of Care* (Chapman and Hall: Routledge, 1993), 118.
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[7] The Sociology Research Unit is coordinated by Caterina Satta and composed of Anna Carreri, Arianna Cattalini, Ester Cois, Valentina Cuzzocrea, Mariella Popolla, Claudia Secci, Enrica Spada.

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VISUALIZING THEORY: ALTERNATIVE PEDAGOGICAL TOOLS FOR ARCHITECTURE EDUCATION

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INTRODUCTION

Across multiple curricular models, the study of architectural theories is a relevant and required component of architectural design pedagogies. According to Korydon Smith, "Theory is the most vital component of the architecture curriculum. Explicit or implicit, architectural theory is the means by which architects and architectural scholars situate themselves in the world."[1] Teaching architectural theory goes hand in hand with studying history, since the two are closely connected. Understanding the history of architecture also means exploring the historical development of architectural theories, and the examination of architectural works would not be complete unless there is a deep examination of the ideas that sustain design approaches. From Vitruvius to Frampton, and including practitioners such as Palladio and Le Corbusier, architects have approached architecture as a reflection of explicit theoretical frameworks through treatises and manifestos. Learning theory is a way for students to enhance the intellectual dimension of architecture and acquire tools to improve design processes.

Teaching architectural theory can be challenging within the undergraduate curriculum. Drawing on seven years of experience teaching architectural theory courses, I have observed that the design pedagogy's strong emphasis on visual learning and formal qualities often leads students to prioritize these aspects over engaging with readings and discussions centered on architectural history and theory. In addition, the hidden curriculum and its increased focus on the architectural design studio as a core component of architectural education may prevent students from taking the time to cover, analyze, and digest readings and lectures, and from participating in seminar discussions.

Architectural theory teaching has also been impacted by the recent prevalence of AI generative tools and their role in developing critical thinking skills. The impact of generative AI tools is evident in both facilitating the production of written assignments and providing a quick way to obtain summaries of complex theoretical readings. Studies already indicate a negative impact on younger learners. A study by Michael Gerlich focused on the relationship between AI use and the development of critical thinking, found that younger participants exhibit greater dependence on AI tools and weaker critical thinking skills.[2] In another study, Roman Yarwich highlighted the risks of algorithmic dependency and cognitive inertia among students who often rely on AI as a shortcut during analytical processes.[3]

In the context of reduced student engagement and widespread use of AI tools, architectural theory education needs to redefine classroom dynamics and assessment methods. Rather than suggesting a reactive approach to these issues, this paper elaborates on a pedagogical tool that enriches the learning experience of architectural theory by leveraging students' skillset to develop graphic communication

techniques. While it is necessary to keep the focus on readings and writing assignments, it is also necessary to reduce reliance on digital tools in the classroom and to leverage the visual and design thinking tools students develop in other areas of the curriculum. The following research questions seem relevant: What new assessment methods can increase teaching effectiveness in theory courses? How can we enhance the learning of architectural theory in the current ecosystem of AI generative tools? How can instructors leverage the design thinking and visual skills in the development of assessment methods for history and theory courses? This paper explores an assessment tool developed in the context of a theory seminar for undergraduate students in which architectural readings are translated into visual constructs. This study explains the rationale and precedents, examines initial outcomes, outlines initial findings, and establishes future steps to continue its implementation and future research.

ARCHITECTURAL THEORY TEACHING

The case study for this paper is the architectural theory seminar, included as part of the Bachelor of Architecture program at American University of Sharjah, UAE. The course is a required component of the fourth year and closes the history-theory sequence in this five-year NAAB-accredited program. According to the syllabus, the Architectural Theory course "Engages the conceptual basis of the work of specific architects, historical and contemporary architectural historians and theoreticians from the 1960s to the present. Examines schools of thought in architecture with an emphasis on the understanding of both written and visual analysis of built form and design."[4] This course examines literature produced in the aftermath of the modern movement's crisis during the early 1960s, a period marked by significant challenges to its ideological and philosophical foundations.[5] The syllabus features works from a range of notable authors, including Robert Venturi, Denise Scott-Brown, Kevin Lynch, Jane Jacobs, Colin Rowe, Hassan Fathy, Dolores Hayden, Aldo Rossi, Kenneth Frampton, Rafael Moneo, Rem Koolhaas, Peter Eisenman, Richard Ingersoll, Juhani Pallasmaa, Fernando Lara, and Jyoti Hosagrahar. Key topics addressed include the interplay between architecture and utopia, perspectives on architecture as a social construct or popular phenomenon, the re-emergence of historical references and disciplinary boundaries, as well as considerations of sustainability and postcolonial approaches.

The assessment methods for the architectural theory course prioritize rigorous critical engagement with theoretical texts and require students to complete a research project that connects these theories to regional case studies. The primary assignment involves composing a research paper based on one of the course readings. Prior to Spring 2024, students were additionally expected to deliver presentations on assigned readings and to utilize an online tool for reading, annotating, and interacting with peers regarding each session's material. Across multiple iterations of the class, it became clear that both the presentation assignment and the pre-class reading annotation exercises were not effective in preparing students for their readings or research. The thoughts and questions submitted ahead of sessions via the online tool did not contribute to in-class discussions, suggesting that students may have generated these comments with AI tools. Additionally, student presentations frequently showed only a partial understanding of the author's ideas, leading the instructor to give a follow-up presentation to clarify and cover the required course material, reducing the time allocated for seminar discussion.

Previous model
Research paper 50%
Assigned reading ~~presentation 20%~~
~~Reading annotation 15%~~
In-class participation 15%

Current model
Research paper 45%
Assigned reading graphic translation 20%
In-class written responses 25%
In-class participation 10%

Table 1. Previous and current assessment methods implemented in the architectural theory courses and their relative weight

In Spring 2024, I decided to implement changes to the course's assessment methods (Table 1). After discussing with colleagues in the department, we decided to stop using the reading annotation tool and the reading presentation, which prompted us to re-evaluate how new assignments fit within the course and the wider curriculum. In considering alternatives, we wanted to ensure that students were still assessed on their ability to develop critical thinking skills when analyzing readings, while also accounting for their limited time due to commitments in other courses, especially the design studio. The online annotation exercise has been replaced by an in-class handwriting assignment, where students respond to one or two questions about the reading discussed. This new approach is designed to help students concentrate and improve their writing abilities. As of spring 2024, the change has led to higher levels of focus and participation, though it also means more grading due to the fifteen readings covered. Despite the increased workload for evaluation, the positive outcomes make it worthwhile.

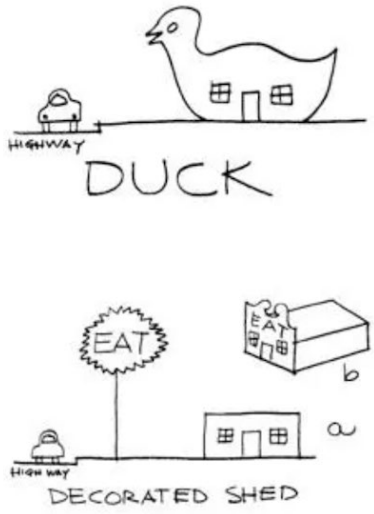


Figure 10 The duck and the decorated shed drawings represent a clear example of how certain theories can be represented through graphic media (Source Venturi, Scott Brown, and Izenour, 2017)

Visualizing Architectural Theory

To substitute for the reading presentation assessment, I designed an assignment that aimed to leverage architecture students' visual learning preferences and graphic communication strengths by having them translate theories into visual constructs. The approach took inspiration from sources such as Venturi, Scott Brown, and Izenour's book Learning from Las Vegas, where a simple and playful diagram is used to explain the complex theoretical construct of the dichotomy between "ugly and ordinary vs heroic and original"[6] A.K.A. *the Duck vs the Decorated Shed* (Figure 1). Another source

of inspiration came from Le Corbusier's diagrams, specifically those devoted to explaining the five points of architecture (Figure 2). In these two cases, the approach is straightforward, with drawings and diagrams elaborated by the authors to expand the audience for these theories beyond the architectural field. A third source comes from the work of the Chilean firm Elemental, led by Alejandro Aravena, which often synthesizes a project's design approach into a graphic equation[7] (Figure 3). In all cases, these are straightforward hand-drawn drawings with just enough content to translate complex design theories into effective media. While they cannot fully substitute for the written narrative, they complement the textual media and increase the dissemination potential of these theories and, in the case of elemental, outline a clear approach to specific architectural works.

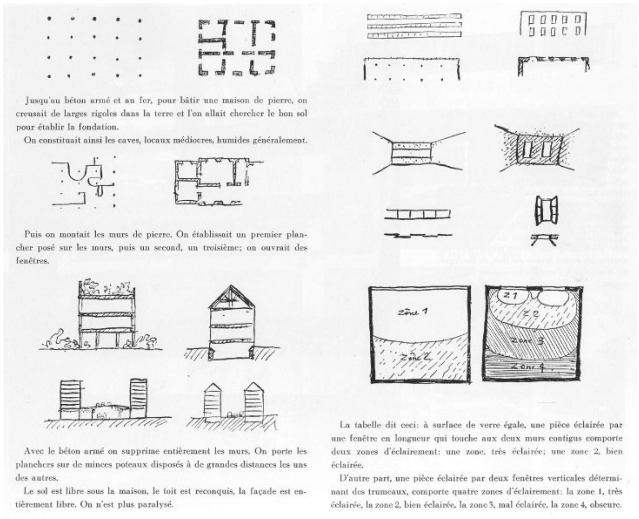


Figure 11. Le Corbusier's description of the five points included simple hand-drawn graphics that capture the essence of each concept

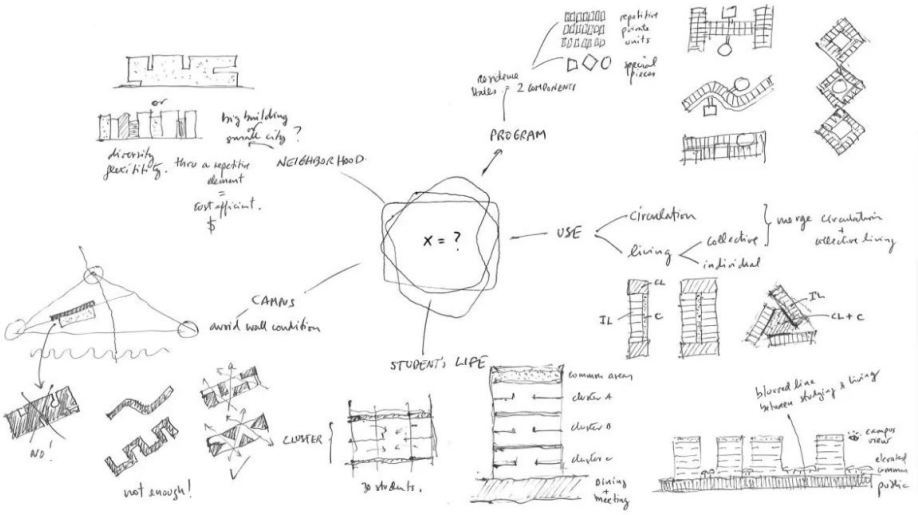


Figure 12. Alejandro Aravena's architectural firm Elemental Chile often includes an "equation diagram" to visualize the design process of some projects.

An additional source of inspiration for this project is Edward R. Tufte's study of data representation methods. Tufte asserts that graphic information tools used to present data frequently lack critical design considerations and often neglect the role of aesthetics in effective communication.[8] In his

book, he presents and categorizes outstanding examples of data visualization in which thoughtful design decisions enhance the comprehension of complex information systems (Figure 4). Tufte's collection, spanning diverse geographies and historical periods, challenges conventional views of the normative function of illustrations in communicating intricate theoretical or data-driven concepts.



Figure 13. The Art of Dancing*, Explained by Reading and Figures by Kellom Tomlinson (1735) is one of the examples highlighted by Edward Tufte in his book* Envisioning Information

ASSIGNMENT IMPLEMENTATION

To kick off the assignment, I begin the course with an introductory lesson focused on Colin Rowe's seminal work, *The Mathematics of the Ideal Villa*.[9] In this session, I explain the theory behind Rowe's analysis and provide a graphic translation (Figure 5). Rowe sought to connect the works of two seemingly disparate architects—Andrea Palladio and Le Corbusier—by identifying their shared approach to designing "beautiful" buildings through similar decisions regarding proportion, composition, and experiential qualities. These qualities, as discussed by Sir Christopher Wren, can reflect either objective aspirations or socially constructed concepts of beauty. As evidence of this unexpected connection, Rowe conducted a comparative analysis of specific residential buildings, highlighting the precise alignment of proportions and geometric grids between Palladio's Villa Malcontenta and Le Corbusier's Villa Stein/DeMonzie. To introduce the graphic assignment, I used this reading to illustrate how this complex text could be summarized diagrammatically (Figure 5).

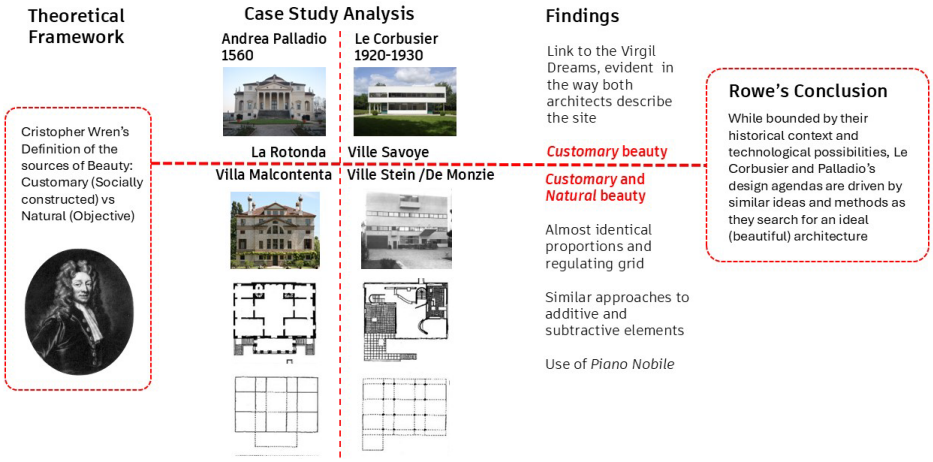
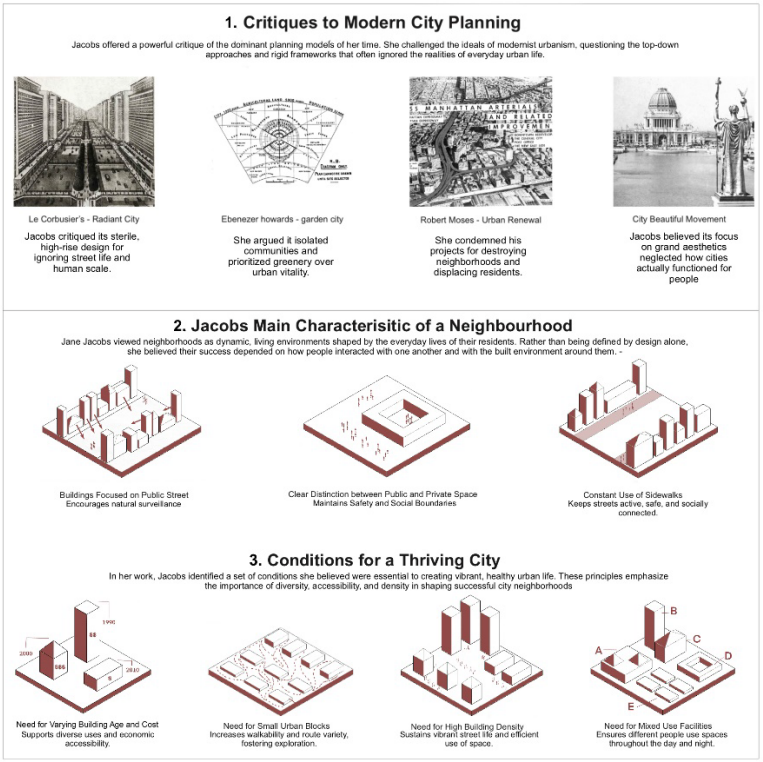


Figure 14. Diagram based on the article "The mathematics of the Ideal Villa" by Colin Rowe (Source: Author)

STUDENT OUTCOMES

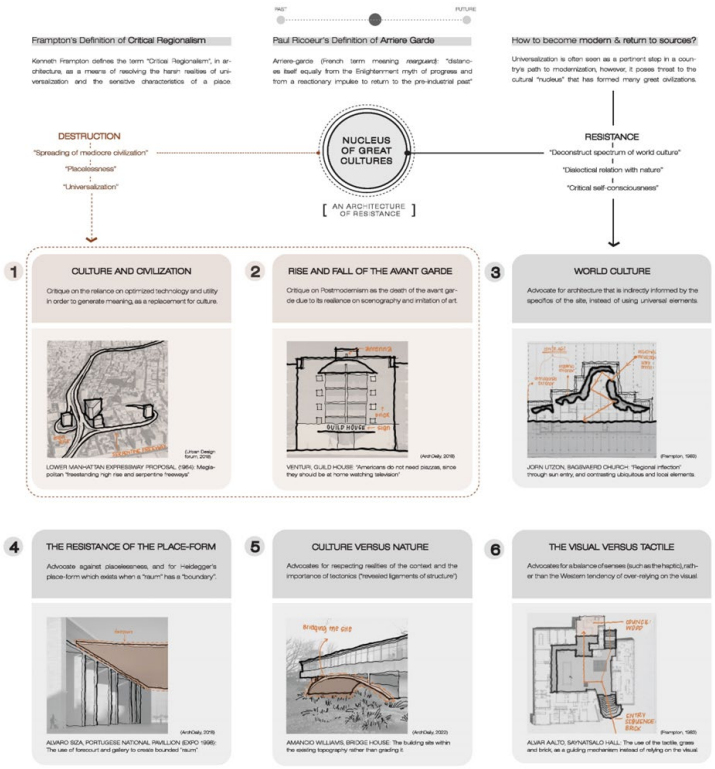
Students produced individual posters in the spring semesters of 2024 and 2025. The implementation of this exercise offered students an opportunity to further understand the author's theoretical approach when developing graphic iterations. In these iterations, students produced graphic narratives that seemed useful in communicating the reading content to a larger audience. As shortcomings, it seemed that most graphic exercises followed a similar, rather conservative, pattern of laying out mostly flowchart-type diagrams. In conversations with the students, it was evident that the graphic exercise required additional iterations to allow students to experiment with diverse approaches. In general, the predominant challenge was finding the right balance between text and graphics.

When we analyze the results of two courses using these assessment methods, we notice a consistent pattern in how students approach the poster assignment: they tend to mirror the sequence of content found in the readings. Most class readings are structured as manifestos, typically highlighting a significant disciplinary issue and proposing a theoretical solution. For example, Jane Jacobs suggests viewing the city as a complex, multi-layered system to challenge the oversimplified perspectives of the City Beautiful Movement, the Garden City, and the Radiant City.[10] Similarly, Robert Venturi advocates a complex, ambiguous architecture in response to what he describes as the reductionism of the modern orthodox movement, exemplified by the work of Mies Van der Rohe and Phillip Johnson.[11] Kenneth Frampton also establishes a background and the problematic of the architecture practice as a commodity in advance of its critical regionalist manifesto. Students who analyzed these readings noticed similar patterns of action and used diagrams to organize their layouts, clearly distinguishing the issues from the proposals (Figure 6 and Figure 7). This method effectively broke down the readings' content and was adopted by most students, serving as a reliable approach to the assignment. While these visual representations made the content easier to understand and aligned with the assignment's goals, I also encouraged some students to experiment with seemingly riskier approaches.



Problem | Solution

Figure 15. Graphic diagram of Jane Jacob's The Death and Life of Great American Cities. *Design by Wed Ahmed*



Background | Solution

Figure 16. Graphic Diagram of Kenneth Frampton's Towards a Critical Regionalism Six Points for an Architecture of Resistance. *Design by Shaikha Sultan*

Other readings do not follow this manifesto template and offer students opportunities for less prescribed approaches. Rafael Moneo presents the evolution of the concept of *type* through a timeline rather than by using a solution-follows-problem format. In an innovative attempt, the student reviewing this work tried to represent Moneo's method using a graph. Although the final product lacks the straightforwardness of the previous examples, this strategy offers a promising direction for enriching the reading by challenging its chronological structure in the proposed graphic. Another way in which students tried to manage some more extensive readings is to focus on the most relevant point made by the author. In the case of Venturi, Scott Brown, and Izenour's book, which offers details of both the analysis and theories involved in the survey of the city of Las Vegas, the student focused rather on explaining the most relevant component of the reading, the dialectical opposition between the concepts of Ugly and Ordinary and Heroic and Original.[12] The result is a more direct diagram organized on a vertical axis, where the student lays out the basic points of this dialectical opposition using original drawings. Compared to the previous examples, these offered less standardized approaches to the assignment, opening the field for more synthetic and potentially more creative outcomes that can also increase the availability of these theories to larger audiences.

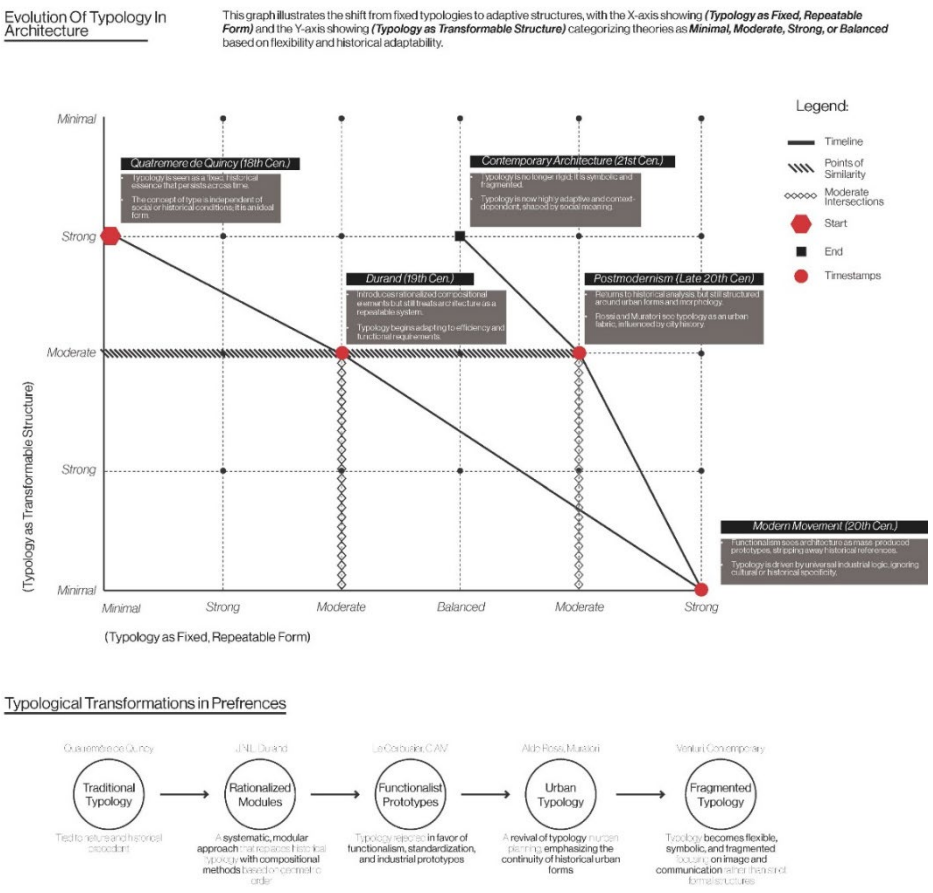


Figure 17. Graphic diagram of Rafael Moneo's On Typology *article. Design by Omar Darwish*

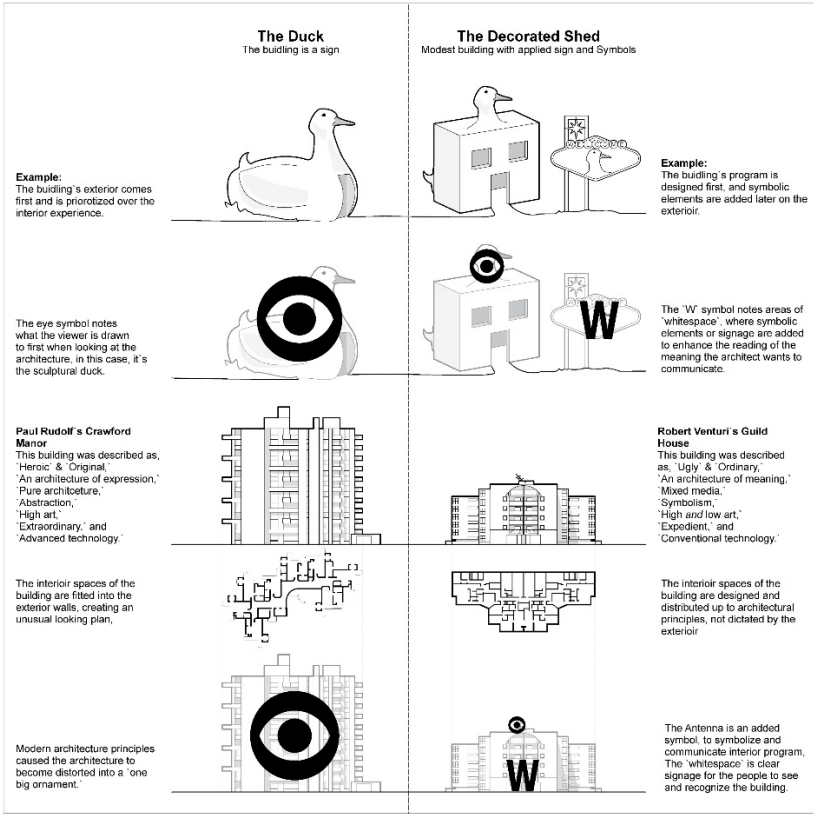


Figure 18. Graphic Diagram of Robert Venturi, Denise Scott Brown and Steve Izenour's book Learning from Las Vegas*. Design by Adela Ghanimeh*

CONCLUSION

In summary, integrating new analytical tools into teaching architectural theory that leverage existing graphic communication skills, has the potential to significantly enhance the learning experience by fostering deeper understanding and engagement with readings. There is, however, an evident dilemma between developing a typical theoretical skillset using writing tools and the need to increase opportunities for students to develop more creative approaches to the graphic translation of architectural theories. The tools that students implemented in this assignment offered dynamic ways to visualize complex concepts, making the subject more accessible and stimulating. Moving forward, maximizing this approach will involve continued research on visualizing tools and precedents, interdisciplinary collaboration with graphic designers, and tailored pedagogical strategies to ensure these visual aids effectively support diverse learning styles and promote critical thinking within architectural education. As a research study, the following steps include conducting further analysis of student outcomes, as well as interviews and surveys of students and colleagues to assess teaching effectiveness and the degree of success in the graphic communication of complex architectural theories.

NOTES

[1] Korydon Smith, *Introducing Architectural Theory: Debating a Discipline* (New York: Routledge, 2012), 2-3
[2] Michael Gerlich, “AI Tools in Society: Impacts on Cognitive Offloading and the Future of Critical Thinking,” Societies 15,1, (2025),1
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[4] ARC421 Architectural Theory Course Syllabus, Spring 2025. Department of Architecture, American University of Sharjah.
[5] (Mallgrave and Goodman 2011)
[6] Robert Venturi, Denise Scott Brown, Steven Izenour, Learning from Las Vegas (Cambridge: The MIT Press, 2017), 88-91
[7] Louisiana Museum of Modern Art, *Elemental Alejandro Aravena* (Denmark: Lars Muller Publishers, 2018)
[8] Edward R. Tufte, *Envisioning Information* (Cheshire, Conn: Graphics Press, 1990), 9,10
[9] Colin Rowe, *The Mathematics of the Ideal Villa, and Other Essays* (Cambridge: MIT Press, 1976), 2-27
[10] Jane Jacobs, *The Death and Life of Great American Cities.* 50th anniversary edition (New York: Modern Library, 2011) 15-39
[11] Robert Venturi, *Complexity and contradiction in architecture.* (New York: Museum of Modern Art, 1977), 16-19
[12] Venturi, Scott Brown and Izenour, *Learning from,* 88-91

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AI AS LEARNING PARTNER: BRIDGING ARCHITECTURE AND DATA SCIENCE THROUGH COLLABORATIVE PROGRAMMING PEDAGOGY

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INTRODUCTION

Architecture graduates enter the profession with powerful spatial intuition. They can read a site, understand circulation, envision how people will move through space. But increasingly, the questions shaping contemporary design demand quantitative literacy: the ability to analyse data, measure patterns, and visualize urban systems at scale. How many residents can reach a proposed park within a 10-minute walk? What correlation exists between street network density and commercial vitality? These are not hypothetical exercises. They are the questions clients, planning departments, and competition juries now expect architects to answer with evidence, not intuition alone. The tools exist. Python libraries like Pandas, OSMNX, and Plotly[1] enable sophisticated spatial analysis. Geographic Information Systems democratize urban data science. Yet architecture programs continue graduating students who outsource quantitative analysis to consultants. The barrier is not technological availability. It is accessibility. Traditional programming pedagogy proves incompatible with architecture students' spatial reasoning, studio commitments, and portfolio development priorities.

This paper documents a pedagogical experiment leveraging artificial intelligence to eliminate the programming barrier without sacrificing analytical rigor. Over eight weeks in Summer 2024,[2] fifteen graduate architecture students with zero programming background learned to conduct sophisticated spatial analysis through a Copy-Run-Recreate framework positioning AI as learning partner rather than content generator. Students first executed instructor-provided code to observe what analysis accomplishes, then used AI assistants to recreate equivalent work on their own datasets. The results were measurable. Students averaged[4] Canvas page views over eight weeks,[3] three times the engagement of traditional sixteen-week programming courses. Eighty-seven percent completed the intensive course, achieving a 97.3% average grade. Students produced portfolio-quality work: isochrone accessibility studies, business diversity correlations, GPS-based circulation mapping. This transformation from programming novice to spatial analyst in eight weeks raises a provocative question: What becomes possible when we teach architects to think analytically with AI partnership?

LITERATURE REVIEW

Urban analytics has consolidated as a data-intensive approach to understanding cities through the joint use of large-scale urban datasets, spatial analysis, simulation/modeling, and prediction to inform planning and design decisions.[4] In parallel, the "big data" turn has raised broader epistemological

questions about how knowledge is produced when research becomes increasingly data-driven, automated, and computational.[5] For architecture and urbanism, this shift matters because core competencies now include not only interpretive reading of place, but also the ability to construct reproducible analytical workflows that connect urban theory to operational evidence.

Within architectural education, digital methods have been framed not simply as new tools, but as a transformation in design thinking and in the knowledge, models used to generate and evaluate form.[6] However, studio and methods courses often struggle to balance technical steep learning curves with conceptual rigor and reflective practice, a tension long discussed in virtual and digitally mediated studios.[7] In this context, open urban data and reproducible computational methods provide a pragmatic bridge between "city science" and design pedagogy. For example, OSMnx enables consistent acquisition and analysis of street networks from OpenStreetMap, supporting transparent, scriptable urban morphological and network analyses suitable for coursework and research.[8]

Most recently, large language models have introduced both opportunities (rapid feedback, scaffolding, code drafting) and risks (overreliance, hallucinated outputs, integrity concerns) that require explicit pedagogical framing.[9] A structured workflow in which learners iteratively copy, run, and then recreate analyses can leverage generative tools as "learning support" while keeping accountability on interpretation, verification, and reproducibility. This aligns with portfolio-oriented learning, where students document process and evidence of growth rather than only final outputs.[10]

THE CHALLENGE – A PARADIGM SHIFT IN SPATIAL INTELLIGENCE

The challenge facing architecture education is not teaching students to code. It is teaching them to recognize that artificial intelligence has fundamentally altered what it means to investigate space.[11] Architects are space specialists, whether analyzing Euclidean space through building geometry, outer space through planetary urbanism, or virtual space through computational environments. Their expertise lies in identifying and reasoning about spatial relationships. What has changed is not the questions architects ask, but the skills required to answer them. Previously, investigating complex spatial relationships demanded specific technical skillsets that created barriers between questions and answers. Want to quantify pedestrian accessibility? Learn ArcGIS for six months.[12] Analyze demographic patterns? Master SQL databases and statistical software. The investigative process was constrained by skills acquisition time. Students with valid spatial questions often could not pursue them because technical implementation required expertise they could not reasonably acquire alongside studio commitments.

AI assistants collapse this barrier between spatial intelligence and technical implementation. The paradigm shift moves value from possessing specific skillsets to asking valid questions and understanding which analytical methods answer them. Students no longer need months of Python fluency to conduct isochrone analysis. They need to understand what isochrone analysis reveals about urban accessibility, then use AI as tutor to implement the technique. Students train AI models on concepts and theories relevant to their spatial questions, then leverage the model as tutor overcoming skills shortages in programming languages and technical implementation.[13] This represents a fundamental shift from traditional process to AI-assisted design intelligence. The traditional workflow positions the designer as specialized user, operating within constraints defined by software capabilities. Data collection requires knowing which datasets exist and how to access them. Data preparation demands mastery of cleaning protocols specific to each software environment. Spatial analysis follows fixed methodologies encoded in tools like ArcGIS, where analytical possibilities are limited to pre-built functions. Throughout this workflow, the designer's spatial intelligence serves the software's operational logic. The investigative process stops when technical knowledge stops.

AI-assisted design intelligence inverts this power dynamic. The workflow begins with user input articulated in natural language, describing spatial questions in architectural terms rather than software commands.[14] When the designer asks, "Which neighborhoods within 15 minutes of the stadium have the highest concentration of restaurants," the AI assistant constructs the necessary workflow: identifying relevant datasets, handling data collection, building spatial databases, executing isochrone analysis, and generating visualizations. The designer defines theoretical framework: what constitutes meaningful accessibility, which metrics indicate commercial vitality, and success criteria for analysis. The AI handles technical execution: writing Python scripts, debugging errors, consulting documentation. Crucially, the designer maintains interpretive authority, evaluating whether results answer the original spatial question and determining how visualizations communicate urban patterns. This collaborative relationship creates a different learning challenge. Students must learn to train AI models on theoretical frameworks relevant to their investigations, providing sufficient context about urban theories and design principles for the AI to generate methodologically appropriate solutions. They must develop judgment about when AI suggestions align with spatial logic and when technical outputs require skeptical interrogation. The pedagogical challenge is teaching students to identify this new creative process, trust AI as legitimate investigative partner while maintaining critical distance and recognize that their value as designers lies in asking questions software alone cannot formulate.

THE COPY-RUN-RECREATE FRAMEWORK

The Copy-Run-Recreate framework addresses the paradigm shift from traditional to AI-assisted design intelligence through a three-phase learning cycle that positions AI as tutor rather than coder. Each phase builds specific competencies while maintaining student control over analytical thinking and spatial interpretation. Students begin each module by copying instructor-provided code examples directly into Google Colab notebooks.[15] This is not passive observation. Copying requires reading code line by line, noticing syntax patterns, identifying where data enters and results emerge. The provided examples solve authentic urban questions using real MLS stadium datasets.[16] Week one introduces Python fundamentals through building height calculations and density comparisons. Week two demonstrates Pandas for filtering businesses by category and mapping demographic distributions. Week three shows visualization techniques for creating isochrone maps and heatmap overlays. Students do not yet understand why specific functions accomplish certain tasks. That understanding comes through execution.

After copying, students execute the code and observe outputs. A matplotlib command produces a bar chart comparing restaurant density across neighborhoods. A Geopandas function generates an isochrone showing fifteen-minute walking accessibility. An OSMNX call retrieves street network geometry and calculates network centrality measures. Running code transforms abstract syntax into concrete spatial analysis. Students see that twelve lines of Python can answer questions that would require weeks of ArcGIS training. They observe how data flows from collection through cleaning to visualization. Crucially, they experience success before understanding. The code works. The analysis produces interpretable results. The outputs look professional. This success builds confidence that spatial analysis through programming is achievable, not reserved for computer science majors. Students who have never written code successfully generate sophisticated urban analysis within their first week.

Having observed what analysis accomplishes and experienced successful execution, students now use AI assistants[17] to recreate equivalent work on different datasets with different spatial questions. A student who copied code analyzing restaurant density near one stadium now asks ChatGPT to help analyze retail business distribution within 800 meters of a different stadium location. The AI becomes

tutor. The student describes their spatial question in architectural language. The AI translates to Python syntax. The student executes, debugs, interprets. When code fails, the student pastes error messages to the AI and learns debugging strategies. When visualizations lack clarity, the student requests styling improvements. The AI does not write code for passive acceptance. It engages in dialogue. The student must articulate what they want, evaluate what the AI suggests, recognize when outputs answer their question and when they require iteration. This trains spatial intelligence to direct technical execution rather than memorizing syntax.

The framework's deeper objective extends beyond mastering specific techniques demonstrated in class. Students learn to navigate an entire investigative ecosystem: Google Colab as accessible workspace requiring no installation, Python as analytical language, LLMs as patient tutors, and the broader landscape of spatial analysis libraries. The goal is self-sufficient exploration. A student completing the course should be able to encounter a new spatial question, ask an AI assistant what analytical approaches exist, learn which Python libraries address that problem, and implement solutions through iterative dialogue. This capacity for independent investigation represents fundamental empowerment. Students no longer depend on consultants to answer data-driven spatial questions. They can immediately engage new problems, use AI to access unfamiliar tools, and produce analytical results. The framework teaches students what exists in the computational urban analysis landscape, what these tools can accomplish, and how to access them through AI partnership without prerequisite programming knowledge. The framework implements accountability through documentation requirements. Students submit Colab notebooks showing copied examples, executed outputs, and recreated analyses with complete AI conversation histories.[18] Assignments require explanation of analytical choices, interpretation of results, and critique of visualization effectiveness. Grading evaluates whether students ask valid spatial questions, use appropriate analytical methods, and interpret results with urban design intelligence. The standard is whether students demonstrate growing capacity to frame spatial problems, direct AI toward solutions, and evaluate analytical outputs critically, shifting learning from syntax memorization to analytical thinking with AI partnership.

RESULTS

The eight-week summer implementation demonstrates measurable learning outcomes through Canvas analytics tracking fifteen architecture students with zero programming background.[19] The cohort achieved 100% completion with all eleven students successfully finishing all assignments and final portfolio projects. Student performance showed exceptional mastery, with seven students earning perfect 100% grades and nine students achieving 98% or higher. The median final grade reached 100% with a mean of 97.73%, indicating that students engaging with the Copy-Run-Recreate framework achieved consistent mastery-level competency in AI-assisted urban analysis.

Canvas engagement metrics reveal a distinct temporal pattern validating the framework's three-phase pedagogical progression. Module resource views decreased systematically from 408 views in Module 1 (Foundation & Setup) through 314 in Module 2 (Stadium Data Analysis), peaking at 428 in Module 3 (Visual Design),[20] then declining through Module 4 (214 views), Module 5 (147 views), Module 6 (88 views), and Module 7 (17 views). This declining pattern occurred simultaneously with sustained assignment submissions, with all eleven students maintaining 100% completion through Module 6 and ten students completing Module 7. The inverse relationship between decreasing material access and maintained performance demonstrates growing student independence through AI partnership rather than dependency on instructor-provided scaffolding. Weekly participation data shows concentrated engagement during the Copy-to-Recreate transition period, with week one generating

1,119 total page views as students established Google Colab workflows, and week two reaching peak participations with 42 assignment submissions as students transitioned from copying instructor code to recreating analyses with AI assistance on different stadium datasets.

Module	Focus	Views	Participations	Reach
1	Foundation & Setup	408	16	100%
2	Stadium Data Analysis	314	23	100%
3	Visual Design	428	29	100%
4	Network Analysis	214	13	100%
5	Interactive Mapping	147	16	91%
6	Density Analysis	88	0	73%
7	GPS Integration	17	0	55%
8	Final Portfolio	-	11	100%

Table 19. Module engagement metrics showing systematic decrease in resource views with sustained assignment completion, indicating student progression from dependent scaffolding to independent AI-assisted analysis.

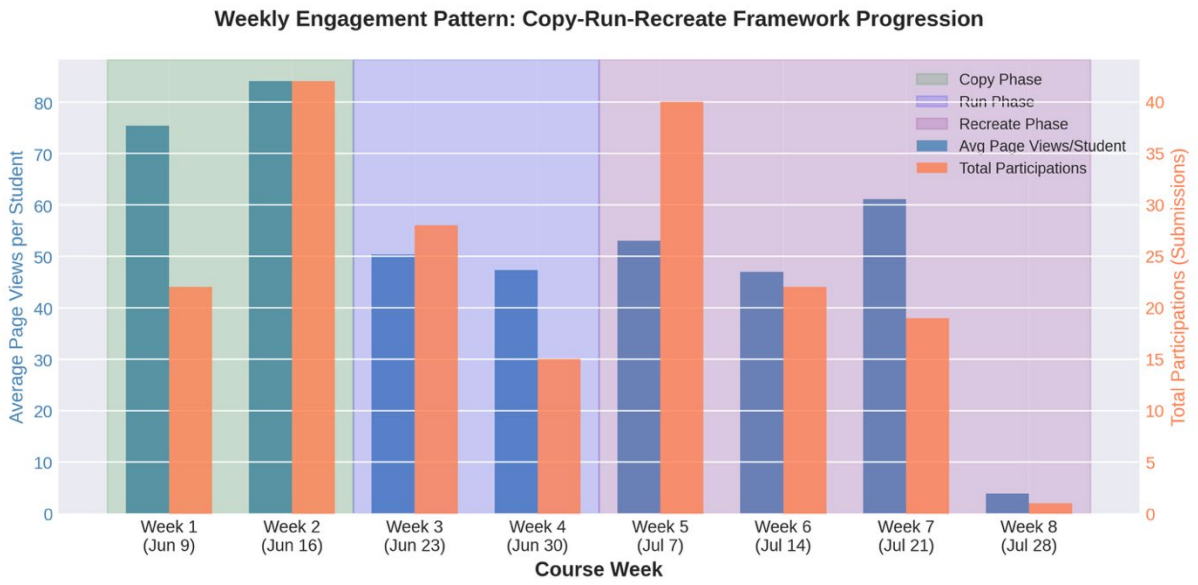


Figure1. Eight-week module progression showing Copy-Run-Recreate framework validation through temporal engagement patterns. Top: Module resource views (bars) and participations (red dots). Middle-left: Student reach percentage. Middle-right: Views-participation correlation. Bottom: Phase summaries. Declining module views with sustained submissions demonstrates student progression from scaffolded learning to independent AI-assisted analysis.

Student Work Examples

Student portfolio submissions demonstrate this framework's capacity to expand architectural students' analytical capabilities, enabling them to explore complex urban questions previously inaccessible without programming expertise. Final projects required students to formulate original research questions comparing five MLS stadiums using techniques from all course modules. Student A investigated whether stadiums centrally located in urban hubs attract higher fan engagement, integrating OSMNX network analysis for distance calculations, business density mapping, and

statistical correlations revealing negative relationships between urban isolation and attendance. Process documentation shows structured AI prompts enabled rapid iteration, allowing focus on interpretation rather than syntax debugging. Student B developed comprehensive circulation and congestion analysis synthesizing isochrone mapping for temporal accessibility, density visualization techniques, residential distribution patterns, and systematic accessibility scoring across eight stadium districts. Forum posts document how the student asked AI what additional visualizations the coordinate data enabled, discovering geographic heatmap generation and isochronal analysis not initially considered. Samuel applied hypothesis-driven comparative research investigating city age and walkability correlation, segmenting five stadiums by development era through business distribution diversity scores, public transit density calculations, and street network quality metrics, representing significant conceptual leap from basic descriptive statistics in early modules to sophisticated multi-variable urban analysis by course conclusion. Student work collectively validates that the Copy-Run-Recreate framework enables architecture students to achieve analytical capabilities typically requiring semester-long programming courses, producing portfolio-quality urban analysis demonstrating both technical competency and design intelligence.

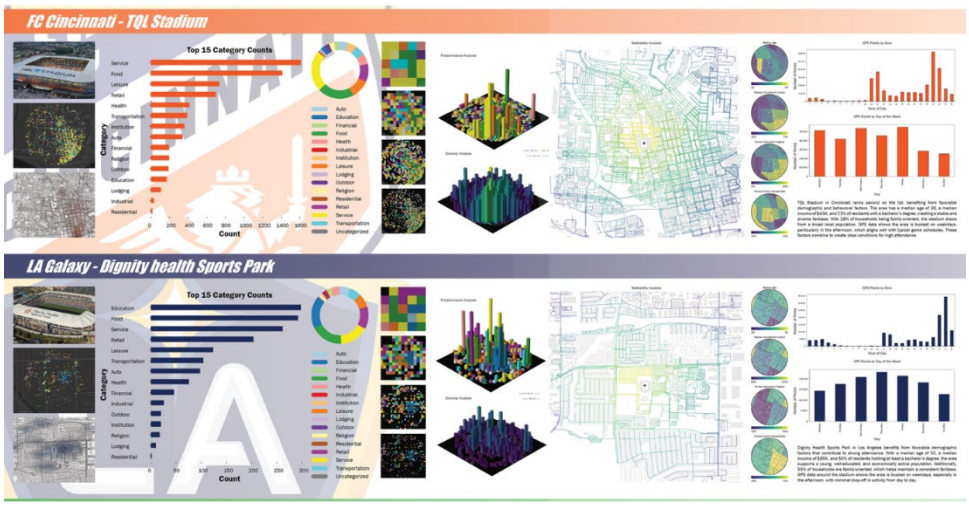


Figure 2. Student A[21] analysis showing negative correlation between distance from urban core and fan attendance.

Figure 3. Stadium analysis showing temporal accessibility and pedestrian density patterns.

DISCUSSION & IMPLICATIONS

The quantitative and qualitative results validate a provocative pedagogical hypothesis: architecture students can achieve sophisticated spatial analysis capabilities without traditional programming instruction when ai serves as learning partner rather than code generator. the inverse correlation between decreasing module access and sustained assignment completion challenges conventional assumptions about scaffolding dependency. students who learned to navigate the ai-programming-ecosystem achieved analytical independence, accessing materials selectively as reference rather than requiring comprehensive review for each task. this pattern suggests that teaching students to ask valid spatial questions and critically evaluate computational outputs may be more valuable than teaching syntax memorization.

The framework's success raises questions about curriculum design in computational design education. if students can achieve portfolio-quality urban analysis in eight intensive weeks through ai partnership, what becomes possible when we restructure semester-long courses around analytical thinking rather than technical skill accumulation? the implications extend beyond architecture. any design discipline requiring data literacy, landscape architecture, urban planning, interior design, faces similar barriers between spatial intelligence and computational tools. the copy-run-recreate framework offers a transferable model for disciplines where professional competency increasingly demands quantitative evidence alongside design intuition.

Limitations merit acknowledgment. the eight-week intensive format demands sustained engagement that may not transfer to traditional semester schedules. the cohort size (n=11) limits statistical generalization, though the 100% completion rate and consistent mastery-level performance suggest pedagogical robustness. most significantly, the framework assumes reliable ai assistant access and performance. students encountered ai hallucinations, incomplete code, and inconsistent responses requiring debugging skills the framework does not explicitly teach.[22] Future iterations must address how students develop critical evaluation of ai outputs beyond pattern recognition.

The broader implication concerns professional practice. architecture firms increasingly market data analytics as design intelligence services. students completing this course demonstrated capabilities, isochrone accessibility studies, diversity index calculations, network centrality analysis, that translate directly to billable consulting work. the framework suggests new revenue streams for practices willing to position spatial analysis alongside traditional design services. more fundamentally, it challenges the disciplinary boundary between architects as form-makers and data scientists as analysts. when spatial specialists can access computational methods through ai partnership, the distinction blurs. what emerges is a hybrid practitioner: architecturally trained, computationally enabled, analytically rigorous.

NOTES

[1] Pandas is a Python library for data manipulation and analysis. OSMNX (OpenStreetMap for Networks) enables acquisition and analysis of street networks. Plotly provides interactive visualization capabilities. All are open-source and freely available yet remain inaccessible to architecture students without programming prerequisites.
[2] The course ran June 9 - August 4, 2024, as an intensive summer graduate elective titled "Mapping is Power: Advanced Urban Data Visualization" (ARCH 600) at the University of Kansas School of Architecture.
[3] Canvas analytics tracked all student interactions with course materials including module views, assignment submissions, discussion forum participation, and resource access. The 454 average represents total engagement across all course components over eight weeks, excluding final project work.
[4] Michael Batty, The New Science of Cities (Cambridge: MIT Press, 2013).
https://doi.org/10.7551/mitpress/9399.001.0001. Establishes urban analytics as the foundational data-intensive framework for planning and design; Michael Batty, "Urban Analytics Defined," Environment and Planning B: Urban Analytics and City Science 46, no. 3 (2019): 403–405. https://doi.org/10.1177/2399808319839494. Formally defines urban analytics, consolidating the computational approaches this course teaches; Stanislas Chaillou, "ArchiGAN: Artificial Intelligence x Architecture," in Architectural Intelligence, ed. Philip F. Yuan et al. (Singapore: Springer, 2020). https://doi.org/10.1007/978-981-15-6568-7_8. Demonstrates AI-driven workflows reshaping architectural design within computational intelligence discourse.
[5] Rob Kitchin, "Big Data, New Epistemologies and Paradigm Shifts," Big Data & Society 1, no. 1 (2014): 1–12. https://doi.org/10.1177/2053951714528481. Raises epistemological questions about data-driven knowledge directly relevant to this framework.
[6] Rivka Oxman, "Theory and Design in the First Digital Age," Design Studies 27, no. 3 (2006): 229–265. https://doi.org/10.1016/j.destud.2005.11.002. Frames digital methods as fundamental transformation in design thinking, not merely new tools; Rivka Oxman, "Digital Architecture as a Challenge for Design Pedagogy: Theory, Knowledge, Models and Medium," Design Studies 29, no. 2 (2008): 99–120. https://doi.org/10.1016/j.destud.2007.12.003. Examines how digital architecture challenges pedagogy at the level of theory and medium.
[7] Thomas Kvan, "The Pedagogy of Virtual Design Studios," Automation in Construction 10, no. 3 (2001): 345–353. https://doi.org/10.1016/S0926-5805(00)00051-0. Identifies the persistent tension between technical rigor and reflective practice in digital studios.
[8] Geoff Boeing, "OSMnx: New Methods for Acquiring, Constructing, Analyzing, and Visualizing Complex Street Networks," Computers, Environment and Urban Systems 65 (2017): 126–139. https://doi.org/10.1016/j.compenvurbsys.2017.05.004. Provides the OSMnx library students use directly for reproducible urban network analysis.
[9] Enkelejda Kasneci et al., "ChatGPT for Good? On Opportunities and Challenges of Large Language Models for Education," Learning and Individual Differences 103 (2023): 102274. https://doi.org/10.1016/j.lindif.2023.102274. Identifies LLM opportunities and risks in education, including hallucination and overreliance concerns; Paul Denny et al., "Computing Education in the Era of Generative AI," Communications of the ACM 67, no. 2 (2024): 56–67. https://doi.org/10.1145/3624720. Argues analytical thinking must replace syntax memorization as computing education's primary objective; Brett A. Becker et al., "Programming Is Hard, or at Least It Used to Be: Educational Opportunities and Challenges of AI Code Generation," in Proceedings of the 54th ACM Technical Symposium on Computer Science Education (SIGCSE 2023) (New York: ACM, 2023), 500–506. https://doi.org/10.1145/3545945.3569759. Documents AI code generation reshaping programming education, validating this framework's core premise.
[10] Helen C. Barrett, "Researching Electronic Portfolios and Learner Engagement: The REFLECT Initiative," Journal of Adolescent & Adult Literacy 50, no. 6 (2007): 436–449. https://doi.org/10.1598/JAAL.50.6.2. Supports portfolio-oriented documentation of process and growth over final outputs alone.
[11] Małgorzata Kurcjusz and Anna Stefańska, "Transformative Integration of Artificial Intelligence in Architectural Design," Architectus 1 (2025): 89–99. https://doi.org/10.37190/arc250109. Confirms AI is fundamentally redefining architectural investigative methods, motivating this pedagogical response.
[12] ArcGIS, the industry-standard Geographic Information System software, typically requires semester-long coursework or professional training certificates. Architecture programs rarely offer such courses, creating a persistent skills gap between spatial design education and quantitative analysis capabilities expected in professional practice.

[13] Widi Cahya Yudhanta and Irwan Yudha Hadinata, "Computational Methods and Artificial Intelligence in the Architectural Pre-Design Process (Case Study: House Design)," Journal of Artificial Intelligence in Architecture 3, no. 1 (2024): 53–60. https://doi.org/10.24002/jarina.v3i1.8431. Demonstrates AI integration in pre-design processes, supporting AI-as-tutor to overcome skills shortages.

[14] Newton D'Souza and Mohammad R. Dastmalchi, "Architectural Creativity Stranded at Mid Journey? Evaluating Creative Potential of Prompts and Images in Generative AI," in Design Computing and Cognition'24, ed. John S. Gero (Cham: Springer, 2024), 224–240. https://doi.org/10.1007/978-3-031-71922-6_15. Evaluates generative AI in architectural workflows, informing this paper's collaborative partner framing.

[15] Google Colaboratory (Colab) is a cloud-based Jupyter notebook environment requiring only a web browser and Google account. It eliminates installation barriers, provides free computing resources, and enables students to execute Python code immediately without configuring local development environments. All course materials were delivered through shareable Colab notebooks.

[16] The course utilized 36 Major League Soccer stadium datasets compiled by the instructor, each containing OpenStreetMap business data (restaurants, retail, services), demographic information from U.S. Census, street network geometry, and GPS tracking data. Students analyzed five stadiums for their final projects, selecting from locations including Seattle, St. Louis, Kansas City, Miami, and Minneapolis.

[17] Students primarily used ChatGPT (OpenAI) and Claude (Anthropic) as programming assistants. Both were accessed through free web interfaces. The course explicitly taught prompting strategies including providing context, attaching code files, numbering instructions, and iterative refinement techniques documented in student process boards.

[18] Documentation accountability addressed academic integrity concerns. Students submitted Colab notebooks preserving all AI prompts, responses, code iterations, and debugging conversations. Grading rubrics evaluated whether students could explain their analytical choices and demonstrate understanding of AI-generated code, not merely its successful execution.

[19] Initial enrollment was 15 students. Four students withdrew in Week 1 due to scheduling conflicts unrelated to course difficulty, leaving 11 students who completed the full eight weeks. The 100% completion rate refers to these 11 students who continued past the add/drop deadline.

[20] Module 3's peak engagement (428 views) coincides with visualization techniques that students recognized as immediately portfolio-applicable. Forum discussions during this week showed students connecting course skills to professional presentation requirements, suggesting portfolio motivation as a powerful pedagogical driver.

[21] Student examples are anonymized per IRB protocols. Student A refers to work examining stadium centrality and attendance correlation. Student B analyzed circulation patterns across eight stadiums. Samuel (identified by request) investigated city age and walkability relationships. All three students achieved final grades of 98% or higher and granted permission for their work to be discussed in this publication.

[22] Common AI failures included: generating code using deprecated library versions, creating non-existent function parameters, producing visualizations with incorrect projections, and hallucinating dataset column names. Students learned to verify AI outputs through execution, cross-reference documentation, and develop skepticism toward confident-sounding but incorrect responses. Future course iterations will explicitly teach debugging AI-generated errors as a core competency.

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FROM ACCURACY TO AGENCY: OPEN SYSTEMS AND CONSTRUCTIVE PLAY IN THE TEACHING OF CONSTRUCTION IN ARCHITECTURAL EDUCATION

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INTRODUCTION

Architecture students often struggle to connect what they learn in construction courses with the thinking, designing, and drawing processes in studios. While creativity is celebrated as a space of freedom in studio culture, construction knowledge is often framed as a set of external and strict rules. Furthermore, it is commonly deferred to post-graduation practice. This divide is not incidental, but structurally reinforced by the dominance of studio culture in architectural education and the marginal positioning of non-studio forms of knowledge and expertise.[1] As a result, students perceive construction knowledge as a rigid and difficult-to-master type of knowledge, while at the same time being expected to learn to competently produce drawings of buildings without understanding how they actually stand, perform, or change over time.

This distinction is particularly evident in early construction courses. Students can draw building elements according to conventions, but they cannot articulate how these elements interact as a system. Drawings become images to imitate rather than tools for reasoning about the relationships between context, construction, and assembly.[2] Accuracy is achieved at the level of representation, while understanding remains underdeveloped—an educational tendency reinforced by pedagogical traditions that privilege representational virtuosity.[3]

In Turkey, construction education has long been shaped by a serious technical ethos inherited from Beaux-Arts traditions, where representation through drawing sits at the center of the tradition, and correctness of linework and adherence to rules are treated as moral virtues. While this legacy has ensured a high level of representational discipline, it has also contributed to a pedagogy of closure. In that approach, technical knowledge is taught as fixed, complete, and authoritative. Uncertainty and experimentation as capacities celebrated in design studios are largely absent from construction courses.

The accuracy-driven approach limits student autonomy and their potential dialogue with knowledge and building systems—echoing broader debates on the urgent need to advance architectural pedagogy beyond inherited models and entrenched educational conventions.[4] When construction knowledge is presented as a hard fact, students are relegated to the position of passive recipients rather than active knowledge seekers. Accuracy becomes an imposed requirement rather than an emerging outcome of reasoning, foreclosing the interpretive dimension through which understanding is formed.[5]

Therefore, our central question is "how can construction pedagogy move beyond representational accuracy to student–building dialogue, and how can it enable students to understand and engage with building construction as open, relational, and interpretable knowledge?"

To address this question, this paper introduces *kurmaca*, which refers to both fiction and fabrication in Turkish. *Kurmaca* reframes learning construction as a form of constructive play within open systems. Instead of teaching construction as a set of rules to be memorized, *kurmaca* positions learning as an interpretive process that emerges through making, testing, failure, and reflection—an approach aligned with hermeneutic understandings of knowledge as something that unfolds through engagement rather than transmission.

This study builds on the authors' earlier action-based research on construction pedagogy, which examined how experiential facilitation and multi-modal engagement can support students' access to construction knowledge.[6] The present paper extends this line of inquiry by shifting the focus from experiential access toward agency, interpretive reasoning, and open systems through *kurmaca*.

COURSE CONTEXT AND PEDAGOGICAL POSITIONING

The pedagogical framework discussed in this paper has been developed within the compulsory construction course sequence of the undergraduate architecture program at Yeditepe University. Within this sequence, the second-semester course Construction 1 and the third-semester course Construction 2 are structured according to the same pedagogical logic. Construction 1 follows Architectural Drawing course and introduces students to fundamental building systems, with a particular focus on low-rise reinforced concrete frame structures, and serves as a prerequisite for the first architectural design studio. Construction 2 introduces timber framed construction.

Conventionally, Construction 1 supports design studios in terms of building elements knowledge and technical drawing competence, prioritizing technical drawing rules and representational accuracy. As in many architecture curricula, the first architectural studios place more emphasis on spatial and functional building knowledge. At this stage, construction knowledge is generally secondary to design. This approach reinforces the perception that construction knowledge is a closed set of rules to consider later and transfer to drawings at the end of the semester. At this stage, students simultaneously develop design habits, representational logic, and assumptions about technical knowledge. Introducing construction as an open, interpretive, and experiential space aims to disrupt the common separation between creative design thinking and technical reasoning. That way, the course treats the construction process as a space where systemic thinking and representational reasoning are developed in parallel with design imagination. Therefore, the course is restructured to carefully frame situations where students encounter the logic of construction through participation, negotiation, and reflection.

SYSTEMS THINKING AND DIAGRAMMATIC REASONING

Lower division construction courses often tend to engage approaches that treat buildings and structures as entities formed by individual elements, which are put together eventually. This approach reflects a long-standing assumption that breaking structures into components is the most effective method of conveying the subject to students. Students learn to draw individual parts, but often struggle to understand how these parts work together. As a result, construction drawings often lack correlation between plans, sections, and details, reflecting a fragmented understanding rather than a relational organization of building systems.

On the other hand, the approach proposed here is based on systems thinking, which understands buildings as networks of interdependent relationships. Systems theorists emphasize that such

networks can be understood through the interactions between their parts, rather than through isolated components.[7] In architectural terms, this means that the environment, building systems, materials, and construction should be conceived not as separate technical issues, but as interrelated layers that interact and change over time, shaping how buildings are made, used, and adapted.[8] In the construction courses redesigned with this approach, students are encouraged to read each element relationally within building systems.

Diagrammatic reasoning plays a central role in this process. This approach overcomes construction drawings as static representations of buildings and positions them as operative diagrams that reveal cause-and-effect relationships between load, support, continuity, and form. This makes systemic relationships readable rather than merely representative. In this sense, diagrams function as speculative tools. They allow students to imagine systems before solving them, creating provisional logics that can then be tested and improved. This speculative dimension opens up space for fiction, a narrative of structure that is imagined, tested, and revised rather than simply copied.

HERMENEUTICS, CONSTRUCTIVE PLAY, AND EXPERIENTIAL LEARNING

Unlike approaches that treat learning as a series of pre-given statements, the pedagogy proposed here takes learning as an interpretive process that emerges through action. It draws on hermeneutics and play theories to illustrate how relational, system-based understanding develops through interaction, interpretation, and revision. In what follows, we operationalize these theoretical premises through *kurmaca* as a pedagogical approach, showing how interpretive learning can be staged through constructive play.

Hermeneutics is a field concerned with the conditions of understanding. It does not treat understanding as the accurate acquisition of predefined meanings. Instead, hermeneutics conceives understanding as an active, situational process that emerges through interpretation. Understanding is shaped by interaction with the world and others. Therefore, meaning is not simply discovered or applied, but rather (co)produced through a continuous movement between what is given and what is interpreted. This movement, described as the hermeneutic circle by Gadamer, involves a back-and-forth between part and whole, expectation and revision, assumption and encounter.[9] If understanding is formed through such interpretive movement, then learning cannot be treated as a linear transfer of stable content, but must be understood as emergent and situated.

From this perspective, learning cannot be fully predetermined, because understanding always exceeds intention. Learning unfolds as an event involving the learner, the situation, and the interpretive frameworks brought into play. Schön conceptualizes this mode of learning as knowing-in-action and reflection-in-action where professional understanding emerges through engagement with indeterminate situations rather than through pre-established rules.[10]

The concept of play becomes central within this interpretive framework. Educational theorists, from Froebel onward, have emphasized that play constitutes a fundamental form for learning, particularly when knowledge is developed through action and experimentation.[11] Through play, learners explore possibilities, test hypotheses, negotiate constraints, and develop intuitive understanding through action. What distinguishes play from mere activity is its openness. In play, outcomes are not entirely predetermined, and meaning emerges through participation rather than instruction.

In his work, Gadamer defines play as a self-moving process that draws participants into its own logic.[12] Play is not governed by the player's will. Rather, the player becomes involved in a movement that develops according to their own dynamics. In this sense, play exemplifies how understanding occurs through dialogue, resistance, and transformation.

The term *constructive play* is used in our work in a deliberately technical sense, closer to *constructional play* than to open-ended play activity. In this context, play is constructive because it is organized around assembly. In constructive play, students learn by testing how elements connect, align, stabilize, and interact as part of a building system. Each move in this play produces structural and spatial consequences that can be evaluated, corrected, and revised. Experiential learning theories have long emphasized that understanding emerges through cycles of action and reflection.[13] Kolb's experiential learning model further conceptualizes learning as a similar movement. In his model, learning moves from concrete experience to reflective observation, and from abstract conceptualization to active experimentation.[14] This learning-through-engagement can also be described as a cyclical process.

The hermeneutic perspective proposes that understanding constructional systems emerges through the construction process rather than preceding it. When students assemble and reassemble structural and spatial systems, the system itself responds through resistance, instability, overlap, or disorder. These responses are situations that invite reflection and reconstruction. Learning unfolds in constructive play and through experiential learning, where constructional reasoning emerges through iterative testing and adjustment rather than through predefined rules (Figure 1).

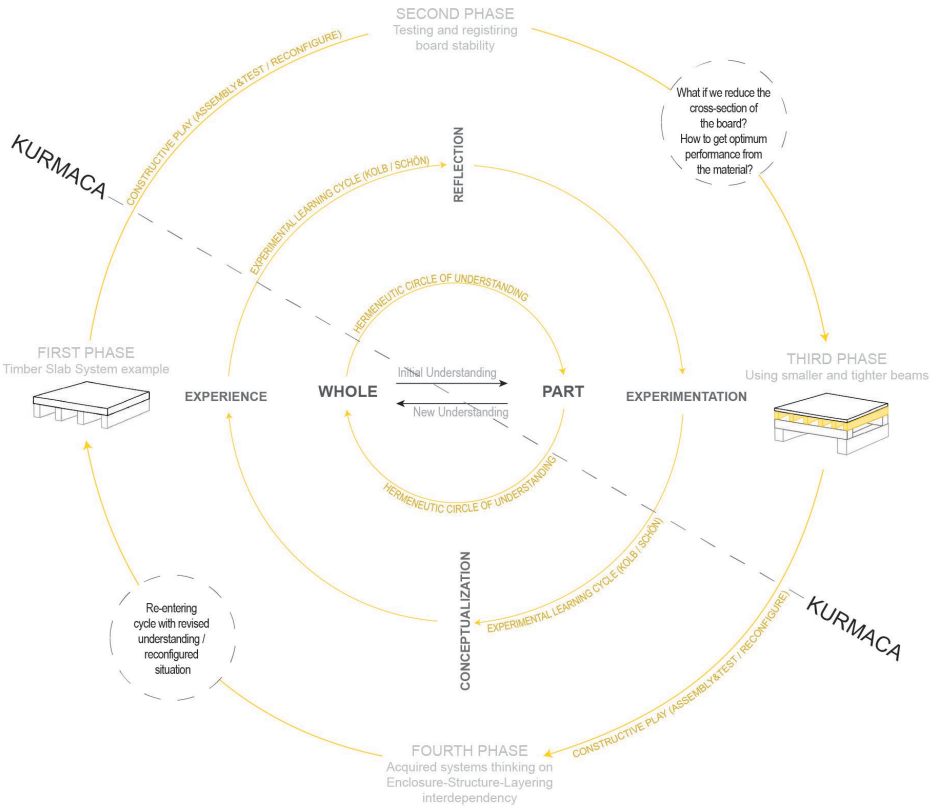


Figure 1. Learning through constructive play as a hermeneutic and experiential cycle (with an illustrative slab system example).

In this context, *kurmaca* is proposed as a key pedagogical concept, and it combines hermeneutics, play, construction, and experiential learning. In Turkish, *kurmaca* simultaneously means fiction and fabrication. It means both forming a narrative and bringing together material elements. It captures a form of reasoning where imagination and material logic are inseparable. Therefore, learning

construction becomes a process of living in uncertainty, of entering the space between what is given and what should be imagined. Within *kurmaca*, drawing becomes a narrative act through which constructional relationships are provisionally composed.

DEVELOPMENT OF SEMI-STRUCTURED TOOLS

Constructive play does not unfold in unstructured freedom, and it cannot be fully scripted through instruction. It requires a carefully designed frame that both enables exploration and resists closure. Consequently, the pedagogy we propose relies on the development of semi-structured learning tools that mediate between openness and constraint.

The necessity of such tools emerges from the limits of explanation-based teaching in construction education. When systems are introduced primarily through lectures or finalized drawings, students encounter construction knowledge as already resolved. In contrast, hermeneutic understanding requires that students confront systems in states of partial definition, where relationships must be inferred, tested, and resolved. Tools therefore help to encounter constructional logic and iterate it toward solution.

The tools developed for this course are deliberately semi-structured and incomplete models that reveal systems of buildings. Their structure provides enough constraint to foreground specific system relationships, such as space, form, structure, envelope, interior layout, while their incompleteness prevents premature resolution. The models deliberately miss systems and elements, miss components, and contain misfitting components. They compel students to interpret how systems might work and overlap and how elements and components get together.

While the pedagogical logic of semi-structured tools is shared across the construction course sequence, it is operationalized differently in each course according to their curricular position and learning objectives. Accordingly, the shared logic of semi-structure is instantiated through different model types in each course.

In Construction 1, the semi-structured tools consist of a set of interrelated physical models accompanying schematic architectural plans. Each draft plan has three complementary model types foregrounding different aspects of the building while remaining open to interpretation and completion. The enclosure model (Table 1) represents the main levels, walls, and wall openings of the draft plan. In this model, components get together and interlock making spatial organization and enclosure legible.

Provided	Left open for constructive play
A draft plan accompanied by components to be assembled to create the enclosure show on the plan.	Kurmaca space: Interpretive completion of enclosure relations through assembly, annotation, and revision. Assembly sequence and alternative configurations; Element identification and level logic; Translation into annotated plans/sections (cuts and notation).

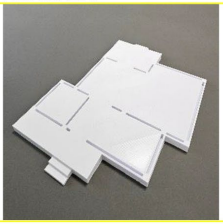
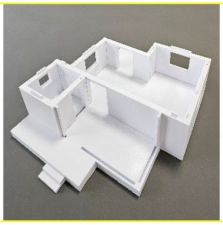
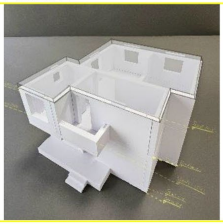
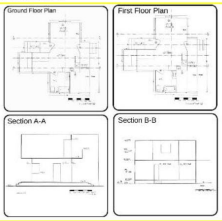
KURMACA	Phase 1	Phase 2	Phase 3
			
Student action	Setting up the enclosure through interlocking components	Marking of the building elements and levels on the model	Creating plans and sections
Student agency	Explorative	Reflective / descriptive	Generative
Activated play	Configurative (assembly / spatial trial-and-error)	Interpretive (reading / naming / diagnosing components)	Translational (re-representing / projecting into drawings)
Generated understanding	Relationship and correspondence between 2D and 3D representations	Identification of building components and their qualities	Representation as annotated drawings

Table 1. The role of the enclosure model in supporting the learning through constructive play in Construction 1 course.

The structural frame model (Table 2) represents the reinforced concrete frame system of the same draft plan. This model is fully assemblable and disassemblable, allowing students to reconstruct the building frame. Interchangeable elements, such as alternative slab and foundation types, enable students to test different structural configurations. Importantly, this model incorporates deliberate incompleteness through missing or misfitting components. These disruptions require students to question load paths, continuity, and spatial logic, turning constructional problems into interpretive prompts.

Provided	Left open for constructive play
Draft plan, enclosure model, and components of the structural system.	Kurmaca space: Interpretive completion of the structural system through configuration, rigidity testing, and correction. Missing/misfitting elements and alternative solutions; Foundation and slab type alternatives; Structural order and interface decisions (frame–slab relations).

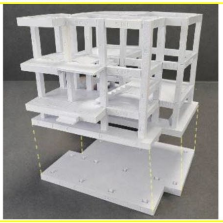
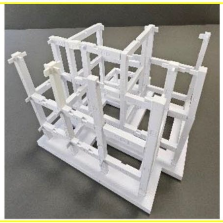
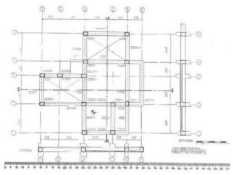
KURMACA	Phase 1	Phase 2	Phase 3
			
Student action	Setting up the structural frame by placing columns and beams, testing alignment and continuity	Integrating slabs into the frame by testing rigidity and stability through frame–slab interfaces	Producing drawings from the built frame and annotating structural logic (grid, span, sizing)
Student agency	Explorative	Evaluative	Generative
Activated play	System-configuration	System-configuration	Translational (re-representing structural logic into drawings and annotations)
Generated understanding	Structural order and load path	Rigidity	Orthographic reasoning

Table 2. The role of the structural frame model in supporting the learning through constructive play in Construction 1 course.

The sectional model (Table 3) is derived from specific section cuts of the draft. By reducing the model to a sectional condition, students are able to focus on how structural continuity, circulation, and spatial experience intersect in three-dimensional space and section rather than in plan alone. Crucially, the model functions as a base for further addition of systems, elements, layers.

Provided	Left open for constructive play
A sectional model that has a number of vertical cuts through different structural elements of the reinforced concrete frame system.	Kurmaca space: Interpretive completion of envelope logic through sectional reading, element completion, and layering. Choice of sectional cuts and representational decisions; Completion of envelope elements (roof form and openings); Completion of wall/roof layers and sequencing of build-ups.

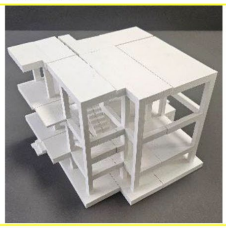
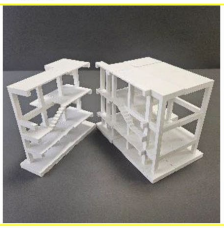
KURMACA	Phase 1	Phase 2	Phase 3
			
Student action	Selecting and reading sectional cuts from the physical model and translating them into 2D section drawings	Completing missing envelope elements	Completing missing envelope layers
Student agency	Explorative	Interpretive	Evaluative
Activated play	Translational (reading the cut and projecting 3D relations into 2D)	Constructive–interpretive (completing elements)	Constructive–evaluative (testing build-up thicknesses
Generated understanding	Correspondence between sectional cut, space, and drawing conventions (cut vs beyond, what to show and annotate)	Understanding the correspondence between form and structure	Understanding construction as layered assembly

Table 3. The role of the sectional model in supporting the learning through constructive play in Construction 1 course.

While Construction 1 operates through draft-specific interpretive models, Construction 2 introduces a different model ecology based on modular systems that can generate multiple architectural configurations. The tools developed for Construction 2 are designed to enable students to construct and test any draft within a defined system logic.

In Construction 2, modular models are developed to represent timber structural systems and their associated envelope components. These include interchangeable wall elements (Table 4). Wall systems are modeled through both platform-frame and balloon-frame constructions, allowing students to compare structural logic, load transfer, and assembly sequences across systems.

Provided	Left open for constructive play
Turkish wooden light frame construction; Studs, beams, and reinforced concrete slab.	Kurmaca space: Interpretive completion of structural logic through rule testing, reconstruction, and system building. Board–beam relationship and beam spacing; Choice of beam type and span logic (A/B/C); Structural hierarchy and system integration decisions.

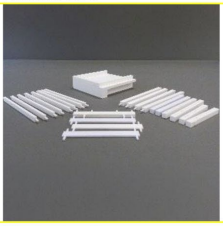
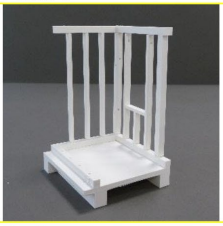
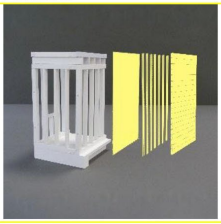
KURMACA	Phase 1	Phase 2	Phase 3
			
Student action	Configuration of a load-bearing wall system	Reading the wall assembly through sectional cuts and translating system logic into section drawings	Completing the wall assembly by identifying and sequencing envelope layers
Student agency	Explorative	Interpretive / descriptive	Evaluative / generative
Activated play	Configurative (testing stud spacing and structural order)	Translational (section-based reading and projection into drawings)	Layering (testing wall build-up sequencing)
Generated understanding	Structural system knowledge	Sectional system understanding	Holistic building knowledge

Table 4. The role of the wall model in supporting the learning through constructive play in Construction 2 course.

Slab model (Table 5) and roof model (Table 6) contain components that can be combined in multiple configurations. Roof models introduce truss-based structures, making spanning, triangulation, and structural depth legible through physical assembly. Because these models are modular rather than draft-specific, students can construct different spatial and structural scenarios. In this context, semi-structure operates not through reference to a fixed drawing, but through a constrained generative system that frames constructive play while preserving openness and interpretive decision-making.

Provided	Left open for constructive play
Timber frame slab; Beams A, B, C with varying cross-sections and span capacities.	Kurmaca space: Interpretive completion of wall systems through configuration, section-based reading, and envelope layering. Stud spacing and load-bearing wall layout; Wall build-up layers and sequencing of layers; Joint decisions (structure–envelope relations).

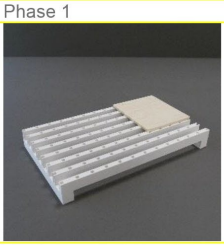
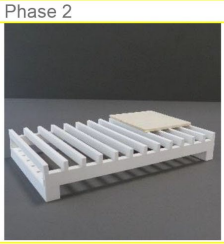
KURMACA	Phase 1	Phase 2	Phase 3
			
Student action	Testing board-beam relationship	Reconfiguring secondary beams	Building the complete slab system
Student agency	Explorative and evaluative	Explorative and evaluative	Generative
Activated play	Rule testing	Structural composition	System building
Generated understanding	Member capacity	Inter-member relationship	System knowledge

Table 5. The role of the slab model in supporting the learning through constructive play in Construction 2 course.

Provided	Left open for constructive play
Gable roof supported by trusses; Specified span capacities for trusses and beams.	Kurmaca space: Interpretive completion of roof structure through configuration, testing, and revision. Truss–support relationships, spacing of truss members, and assembly sequence.

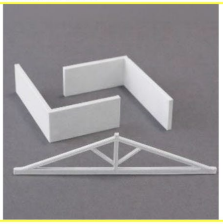
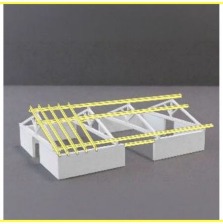
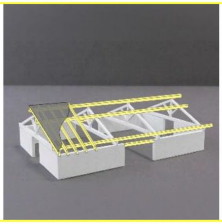
KURMACA	Phase 1	Phase 2	Phase 3
			
Student action	Configuring truss support and span relationships	Introducing and testing the need for secondary beams	Assembling the complete roof system
Student agency	Explorative	Evaluative	Generative
Activated play	Rule-based configurative (testing span, support, and triangulation)	Structural composition (integrating secondary members and revising load paths)	System integration (coordinating trusses, beams, supports, and cover as a whole)
Generated understanding	Member capacity	Inter-member relationships	Roof a coherent structural and envelope system

Table 6. The role of the roof model in supporting the learning through constructive play in Construction 2 course.

Construction I course mainly focuses on interpretive reading and completion of given architectural drafts, while Construction II course shifts toward generative reasoning through modular system construction. Within this framework, representational accuracy is no longer treated as a prerequisite for learning but as an outcome that emerges through interpretive engagement with open systems.
These semi-structured tools operate as pedagogical interventions whose effects cannot be fully anticipated in advance. Understanding how they shape learning therefore requires a methodology attentive to situated action, observation, and iteration. Accordingly, an action-research methodology has been employed to examine and iteratively recalibrate the pedagogy and its tools.

ACTION RESEARCH FRAMEWORK AND COURSE IMPLEMENTATION

Action research positions teaching as a reflective and iterative practice, and instructors act simultaneously as educators and researchers, generating knowledge through lived classroom experience. The action-research process in this study (Figure 2) follows a cyclical structure of planning, acting, observing, and reflecting, as articulated by Carr and Kemmis.[15]

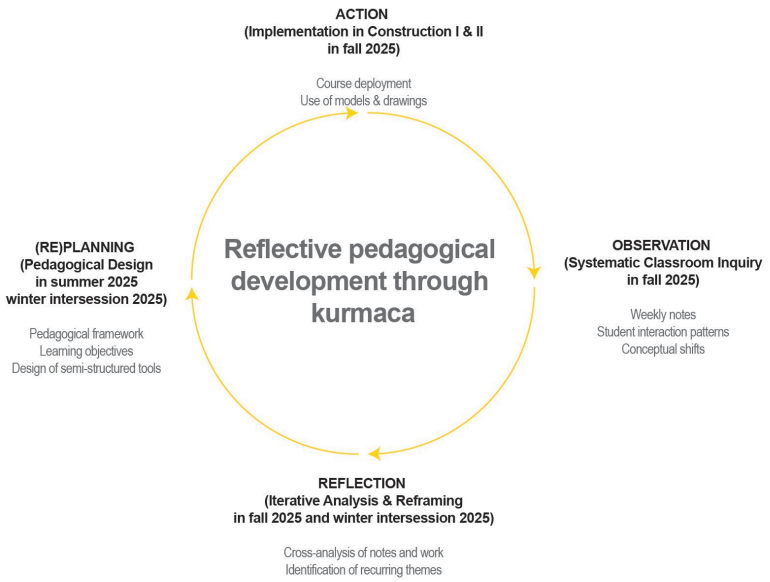


Figure 2. Action-research framework structuring the iterative design, implementation, observation, and reflection of semi-structured tools and constructive play pedagogy in Construction I and II.

In the planning phase, which began in Summer 2025, the pedagogical framework was articulated, learning objectives were defined, and the semi-structured tools were designed, prototyped, and produced through 3D printing. This phase focused on translating the theoretical premises of systems thinking, hermeneutic learning, and constructive play into instructional and material form.

Within the initial implementation in Fall 2025 across Construction I and Construction II, the tools and course structure were deployed for the first time in a live teaching context. Observations of student work and in-class interactions constituted the primary sources of reflection.

Classroom observations were conducted systematically throughout the Fall 2025 semester. After each weekly class session, the instructors recorded written observation notes focusing on student engagement, modes of interaction with models and drawings, recurring difficulties, and moments of conceptual breakthrough. These observations were paired with a weekly submission cycle: students began working on drawing and modeling tasks during class sessions and completed and submitted the same tasks as homework within the following week. This structure enabled the instructors to observe both in-class processes and the evolution of student reasoning over time. Patterns were identified through iterative reading of weekly notes in relation to student-produced drawings, models, and questions raised during critiques. The observations inform ongoing adjustments to the order of activities and instruction, the use of tools, and the framing of lectures and critiques.

At the time of writing, the study remains within the reflective and replanning phase of the action-research cycle, with preliminary findings from the Fall 2025 implementation informing revisions planned for Spring 2026. Rather than concluding the research process, these early observations function as inputs for the next cycle of planning and action, reinforcing the iterative nature of the methodology.

This cyclical structure of planning, acting, observing, and reflecting mirrors the hermeneutic movement between part and whole. Individual teaching interventions are continuously reinterpreted by instructors in relation to the evolving understanding of the course as a system, and the course as a

whole is reshaped through reflections on situated actions. These insights from preliminary results inform the discussion of how semi-structured tools and constructive play can support agency and systemic reasoning in early construction education.

PRELIMINARY FINDINGS

Preliminary findings are derived from systematic classroom observations conducted throughout the Fall 2025 implementation of Construction I and Construction II. These findings identify recurring themes in how students engaged with construction knowledge, representations, and learning tools during the first cycle of implementation.

A primary observation concerns the role of physical models in accelerating students' entry into construction reasoning. The availability of pre-fabricated, disassemblable models reduced executional friction and allowed students to engage with plans, sections, and constructional logic earlier than typically observed in previous semesters. Students frequently used the models as spatial and dimensional references while drawing, cross-checking levels, spans, and alignments collaboratively. This facilitated a more immediate translation between three-dimensional systems and two-dimensional representations.

At the same time, observations indicate that engagement with the models occurred at different epistemic depths. While many students used the models to test assumptions and reason through system relationships, others relied on them in a more procedural manner, using the models to complete drawings without articulating underlying logic. Rather than eliminating rote behavior, the tools made differences in learning approaches more visible.

Another consistent finding relates to sectional reasoning. Students initially struggled to understand what is cut versus what is seen in section drawings. The introduction of sectional models, physical cutting demonstrations, and overlay techniques resulted in marked improvement in students' ability to construct sections and relate them to plans. Several repeating students explicitly indicated that these methods enabled understanding that had not emerged in earlier course iterations.

Observations also reveal that procedural knowledge—particularly the sequencing of drawing actions—constitutes a critical threshold. Students often understood elements conceptually but hesitated or made errors when initiating drawings. Live demonstrations of drawing order produced immediate improvements, suggesting that systems thinking must be supported by explicit procedural scaffolding.

Finally, hands-on sessions generated high levels of engagement and peer interaction, but also exposed temporal constraints. Constructive play deepened understanding, yet required careful calibration within the limits of semester pacing.

Overall, the observations suggest a shift from representational accuracy toward interpretive and systemic engagement, while highlighting the need for ongoing refinement of scaffolding and time allocation in future cycles.

CONCLUSION

This paper argues for a shift in early construction education from representational accuracy toward student agency, reframing construction knowledge as an open, interpretive, and systemic practice. Drawing on systems thinking, hermeneutic learning, and constructive play, and supported by semi-structured physical tools, the study demonstrates how construction can be taught as a field of reasoning that emerges through participation, interpretation, and revision. Within this framework, *kurmaca* operates as a pedagogical logic that holds together imagination and construction.

The proposed approach is not a shift from drawing to making, nor from representation to fabrication. Rather, it is a shift from drawing as imitation toward drawing as interpretive reasoning. In this

framework, orthographic drawings function as tools for thinking through systems rather than as measures of correctness. Physical models do not replace architectural drawing. Instead, they operate as mediating devices through which structural and spatial relationships can be negotiated, tested, and discussed.

Methodologically, the study is limited by its situated scope and by its position within the first cycle of an ongoing action-research process. The findings are therefore preliminary and qualitative, relying on classroom observation rather than longitudinal measurement. Nevertheless, although developed within a specific institutional context, the pedagogical rationale of semi-structured tools and constructive play can be adapted to other early construction curricula.

Future phases of the research will refine the tools, scaffolding strategies, and temporal organization of lessons, contributing to a more robust understanding of how student agency can be systematically cultivated in construction learning.

ACKNOWLEDGEMENTS

This research was supported by the Department of Architecture at Yeditepe University for the production of physical models. The authors thank the university administration for their support and Erdal Kondakcı for technical assistance with 3D printing.

NOTES

[1] Peggy Deamer, “Design Pedagogy: The New Architectural Studio and Its Consequences,” *Architecture_MPS* 18, no. 1 (2020): 2, https://doi.org/10.14324/111.444.amps.2020v18i1.002.
[2] Marco Frascari, “The Tell-Tale Detail,” *VIA 7, The Building of Architecture* (1984): 22–37.
[3] Deamer, “Design Pedagogy,” 3.
[4] Ashraf M. Salama, “Advancing the Debate on Architecture, Planning, and Built Environment Research,” *ArchNet-IJAR: International Journal of Architectural Research* 9, no. 2 (July 2015): iv–viii.
[5] Hans-Georg Gadamer, *Truth and Method*, 2nd rev. ed., trans. Joel Weinsheimer and Donald G. Marshall (London: Continuum, 2004).
[6] Bahar Aktuna and Esra Karahan, “Grafting Construction Thinking: An Action-Based Approach to Construction Course Redevelopment,” in *Beyond Blueprints: Advancements in Architectural Education and Innovations*, ed. H. R. Husain and H. A. Nia (Istanbul: Cinius Yayınları, 2023), 23–50.
[7] Donella H. Meadows, *Thinking in Systems: A Primer*, ed. Diana Wright (White River Junction, VT: Chelsea Green Publishing, 2008); Peter Checkland, *Systems Thinking, Systems Practice* (Chichester: John Wiley & Sons, 1981).
[8] Simon Austin and Robert Schmidt, *Adaptable Architecture: Theory and Practice* (London: Routledge, 2016), 32–37, discussing N. John Habraken’s Support/Infill and Stewart Brand’s “shearing layers” concept.
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[11] Maria Voyatzaki, ed., *The Teaching of Construction in Architectural Education: Current Pedagogy and Innovative Teaching Methods*, EAAE Transactions on Architectural Education no. 12 (Thessaloniki, Greece: EAAE & ENHSA, 2002).
[12] Gadamer, *Truth and Method*, xiv, 102–103.
[13] Linda H. Lewis and Carol J. Williams, “Experiential Learning: Past and Present,” *New Directions for Adult and Continuing Education*, no. 62 (1994): 5–16, https://doi.org/10.1002/ace.36719946203.
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MARGINS, CENTERS, AND THE OPEN FIELD: EXPANDING ARCHITECTURAL THEORY FOR DESIGN STUDENTS

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INTRODUCTION

Architectural theory occupies a paradoxical position within contemporary design education. Since its institutionalization in the postwar academy, theory has been understood as architecture's critical conscience, a space of reflection through which the discipline establishes intellectual legitimacy and interrogates its own assumptions. At moments of disciplinary uncertainty, such as the crisis of modernism, the emergence of postmodern pluralism, or more recent shifts toward digital, environmental, and data-driven paradigms, theory has provided architecture with a means of recalibrating its relationship to broader cultural and political life. Yet contemporary curricula, increasingly shaped by accreditation requirements, professionalization, and expanding technical demands, often reduced theory to a historical survey or a largely textual exercise detached from the practices of design.[1] At stake is not only the content of architectural theory, but its capacity to function as a critical mode of inquiry that meaningfully connects architecture to the social, political, and spatial systems in which the discipline operates.

This paper argues for architectural theory to be reframed not as a closed canon or discrete disciplinary domain, but as an open, relational, and practice-based field of inquiry, one that supports the development of critical thinking and problem-solving skills in students that are transferable to architectural practice. Such a reframing restores theory's conceptual vitality while aligning its pedagogy with the relational, ecological, and systemic modes of thinking that increasingly define contemporary architectural work. To demonstrate how this expanded understanding of theory can be cultivated pedagogically, the paper examines the recent redesign of a required undergraduate architectural theory course and its central research-based assignment. Read together, the course structure and assignment function as a testing ground for how theory can operate not only as historical or textual knowledge, but as an active method through which students learn to navigate architecture's conceptual, political, and material entanglements.

The Emergence and Consolidation of Architectural Theory

Prior to the 1960s, most North American design programs followed either a Beaux-Arts emphasis on compositional mastery or a modernist focus on functional and technical problem-solving, with intellectual engagement occurring primarily through the analytical study of precedent rather than sustained philosophical or theoretical discourse. The emergence of architectural theory as a discrete component of the curriculum in the late 1960s and 1970s thus reflects not a long-standing disciplinary tradition, but a historically specific response to broader cultural and intellectual shifts. As architecture

absorbed critical frameworks from the humanities and social sciences also part of a wider "theoretical turn" in fields such as art history, literary studies, and film theory, the field of architectural theory took shape as a formalized domain of knowledge.[2]

Within architecture, figures such as Manfredo Tafuri and Aldo Rossi reoriented the discipline's relationship to history, positioning it not as a progressive narrative but as a site of ideological critique.[3] These ideas took institutional form at a small number of influential programs. At Cornell, Colin Rowe's analytical method framed theory as a mode of design reasoning; at MIT, the History, Theory, and Criticism program emphasized scholarly and philosophical rigor; and at Princeton and Cooper Union, formalist and phenomenological debates were translated directly into studio experimentation.[4] By the 1980s, architectural theory had become both a credential and an institutional infrastructure, consolidated within elite academic contexts that shaped how architectural knowledge would be defined and transmitted for decades.

Publication played a critical role in this consolidation. Journals such as *Oppositions*, published by the Institute for Architecture and Urban Studies, and later *Assemblage* at the Harvard Graduate School of Design, functioned not merely as records of discourse but as active sites of theory production. Across these platforms, writing itself became a form of architectural work, translating ideas from Marxism, semiotics, psychoanalysis, and post-structuralism into the conceptual language of design. Theory achieved disciplinary autonomy, establishing architecture as a critical and cultural practice with its own internal logics.

From Disciplinary Core to Relational Practice

This early, formal integration of theory into architectural education is a relatively recent development, a fact that is often overlooked but carries important pedagogical implications. Recognizing this relatively recent and contingent formation is crucial to understanding architectural theory not as a fixed or naturalized body of knowledge, but as a constructed and evolving field, one open to critique, reinterpretation, and pedagogical reconfiguration in relation to changing conditions of design practice and education. By the mid-1980s, the consolidation of theory had begun to attract sustained critique, one which continues in the 21st century. What had once promised intellectual rigor and disciplinary legitimacy increasingly appeared insular, privileging internal coherence over engagement with the material, social, and political realities of building.

At the same time, thinkers outside architecture were modeling alternative approaches to disciplinary identity. Rosalind Krauss's "Sculpture in the Expanded Field" proposed a relational model in which disciplinary categories could no longer be defined by essence but only through structural positions and adjacencies.[5] Douglas Crimp extended this logic in "Appropriating Appropriation," arguing that cultural production operates through borrowing and translation rather than originality. Crimp distinguished between historical citation and what he terms lateral appropriation, the borrowing of methods and materials across fields of contemporary practice.[6] In this distinction, architecture provides two contrasting models: Michael Graves's return to classical imagery exemplifies a nostalgic, inward-looking reuse of form, while Frank Gehry's engagement with the raw materials and logics of construction points to a more generative, critical mode of appropriation. The distinction between historical citation and lateral appropriation, positioned theory as an interpretive and connective practice rather than a self-contained language.

Even more recent reconsiderations of theoretical formations from feminist and practice-based scholars further demonstrated how claims to disciplinary purity often masked deeper entanglements with systems of gender, race, labor, and power.[7] For example, architectural academic Dana Cuff has reframed these critiques within an explicitly political and spatial register. In her recently published

text *Architectures of Spatial Justice*, Cuff argues that architecture cannot be understood apart from the inequities it both reflects and produces, and that disciplinary autonomy functions as a fiction that obscures architecture's embeddedness within broader systems of power and governance.

Together, Krauss, Crimp, and Cuff provide a framework for understanding architectural theory as an expanded field, one whose vitality emerges at its margins through relation, translation, and engagement rather than through disciplinary closure. Read in sequence, their work traces a gradual but decisive shift away from theory as a self-contained intellectual project and toward theory as a mode of critical practice that is inseparable from the social, cultural, and material conditions of architectural production with additional, significant implications for design pedagogy. If architectural theory is understood not as a stabilized body of knowledge but as a historically contingent and continually reconstituted field, then its role within the curriculum must likewise remain open to revision. Teaching theory, in this sense, becomes less about transmitting an authoritative canon and more about equipping students with the critical thinking tools needed to interrogate architecture's boundaries, assumptions, and institutional formations. The expanded field thus offers not only a historiographic corrective, but a pedagogical framework that positions theory as an active method through which students learn to navigate complexity, negotiate disciplinary limits, and engage architecture's ethical and political stakes as part of design practice itself. If architectural theory is to function as an expanded, relational field rather than a stabilized canon, its pedagogical formats must also be reconsidered. The course case study that follows demonstrates how this shift can be enacted through curricular design, positioning theory as an active method embedded within architectural education rather than as a discrete body of historical knowledge.

COURSE CASE STUDY: REFRAMING THEORY THOUGH AN EXPANDED FIELD

In Fall 2024, the required undergraduate architectural theory course for design students at the University of Virginia's School of Architecture was substantially reimagined. The redesigned *Theories of Architecture* foregrounded the plurality of spatial discourse in the twentieth and twenty-first centuries and examined architecture not as an isolated discipline but as a field constituted through its intersections with other modes of knowledge and practice. Rather than presenting theory as a closed historical canon, the course framed it as an open and evolving terrain shaped by ongoing cultural, political, technological, and environmental conditions.

The conceptual framework for the course was explicitly presented to students as building on the positions of Krauss, Crimp, and Cuff each of whom argues, albeit from distinct disciplinary positions, advocating for necessity of destabilizing rigid disciplinary boundaries in order to sustain critical relevance. In *Architectures of Spatial Justice*, Cuff asserts that "to construct practical architecture is to break open the well-defined core of the architectural discipline so that it absorbs and is transformed by what were considered the margins," emphasizing that those margins are "wider and more populous than in most disciplines because the core has been so rigidly defined."[8] Her argument positions disciplinary expansion not as dilution but as a productive and necessary condition for architectural practice.Crimp similarly advances a critique of disciplinary enclosure, arguing that the determinants of a field must be broken down in order for "a whole range of new possibilities for knowledge" to emerge, possibilities that cannot be anticipated from within an established disciplinary framework.[9] Krauss's earlier formulation of the "expanded field" provides a critical precedent for both positions, mapping architecture, landscape, and art as relational rather than autonomous categories whose meanings are produced through adjacency, overlap, and difference.[10] Taken together, these interlocutors offer a conceptual foundation for approaching architectural theory as a dynamic and relational practice rather than a fixed body of knowledge. These understandings informed not only course content but also structure and tone.

Course Content and Structure

In Fall 2024, the required undergraduate architectural theory course for design students at the University of Virginia's School of Architecture was substantially reimagined. *Theories of Architecture* is a required third-year course within a pre-professional Bachelor of Science in Architecture program and fulfills NAAB's History and Theory accreditation criteria, which emphasize an understanding of architecture's histories and theories as shaped by diverse social, cultural, economic, and political forces. Students enrolled in the course were expected to have completed a two-part global architectural history survey, providing a shared foundation of historical knowledge spanning early spatial practices through the twentieth century. This curricular positioning allowed the theory course to move beyond historical coverage and instead focus on theory as an interpretive and critical method. The reconceptualized *Theories of Architecture* foregrounded the plurality of spatial discourse in the twentieth and twenty-first centuries and approached architecture not as an isolated discipline, but as a field constituted through its intersections with other modes of knowledge and practice.

Within this context, theory was explicitly framed as a tool for understanding the built environment across scales and temporalities, with direct implications for design practice. The course departed from a chronological survey model and instead adopted a thematic structure organized around a series of units framed as "Architecture + _____." This format emphasized architecture's productive margins, foregrounding its intersections with adjacent disciplinary formations rather than reinforcing a singular theoretical lineage. Course units addressed topics such as political economy, human and non-human subjectivities, representation and media, environmental psychology, ecology and geology, urbanism and landscape, emergent technologies, and professional ethics. By tracing how theoretical frameworks from other fields have shaped architectural thinking historically and contemporarily, students were encouraged to understand both the core concerns of architectural discourse and the porous boundaries through which those concerns are continually redefined as they emerge from other fields and relate to spatial concepts.

This expanded-field approach informed not only the organization of course content but also its pedagogical structure. Rather than positioning students as recipients of a stabilized body of theoretical knowledge, *Theories of Architecture* was designed to function as a site of ongoing disciplinary negotiation, with built-in mechanisms for reassessing the scope, emphasis, and relevance in response to emerging discourses as weekly readings were presented in lecture and discussed in smaller section meetings led by Graduate Teaching Assistants. This fluidity of themes, discussion, and the expansion and contraction of what course participants felt was relevant discourse was reinforced through a semester-long research assignment that asked students to actively contribute to the mapping of contemporary architectural theory, positioning theory as a collective, evolving field rather than a fixed canon to be mastered.

The State of the Field Project

While the thematic structure of the course enabled a broader range of theoretical topics to be introduced, the constraints of a single semester necessarily limited the depth with which any one discourse could be explored through lectures and readings alone. To address this limitation, students completed a semester-long assignment titled the *State of the Field Project*, which positioned theory as an open and collectively constructed terrain.

The project introduced students to rigorous research practices and guided them through the process of developing research questions, evaluating scholarly sources, and articulating the relevance of emerging discourses to architectural theory and practice. The introduction of these skills were

intentionally aligned with those required to be engaged at an even deeper level subsequent research-based studios, history/theory seminars, and the undergraduate thesis sequence.

Working in small groups of three to four, students identified an emergent or underrepresented theoretical discourse shaping contemporary architectural practice. Groups could either extend a topic introduced in the course or propose a field not explicitly addressed in the syllabus. The assignment unfolded in three components. First, each group defined the scope of its chosen field and articulated its relevance to architectural theory in a short introductory essay. This essay was framed not as a single statement of the scope of their topic but took on an argumentative stance for the topic's relevancy. Second, students assembled a curated bibliography of twenty scholarly sources, each accompanied by an extended annotation situating the text and assessing its methodological and theoretical contributions. This component functioned as a literature review, emphasizing scholarly rigor and disciplinary positioning. Finally, each group produced a diagram visualizing the discursive field they had constructed, mapping relationships among key concepts, themes, and contributors.

The collaborative structure of the project introduced a productive tension between individual interests and collective synthesis. As students negotiated the scope and boundaries of their defined fields, they were required to continually reassess their assumptions, refine subcategories, and position sources within a shared conceptual framework that met the expectations and interests of the group. In this sense, the project enacted the very operations described by Krauss, Crimp, and Cuff: appropriation, translation, and re-composition across disciplinary boundaries.

Outcomes and Reflections

The range of topics proposed through the *State of the Field Project* was expansive. Some groups explored established discourses such as aesthetics, architectural style, vernacular traditions, and sensorial perception, as illustrated in the student generated diagram seen in Figure 1. Others addressed socio-political and environmental concerns, including postcolonial spatial identity, the urban dynamics of ethnic enclaves, critiques of architectural typologies, environmental psychology, architectural labor and material extraction, and architecture's relationship to the Anthropocene through systems thinking and ecological models, samples of which are illustrated in Figures 2 and 3.

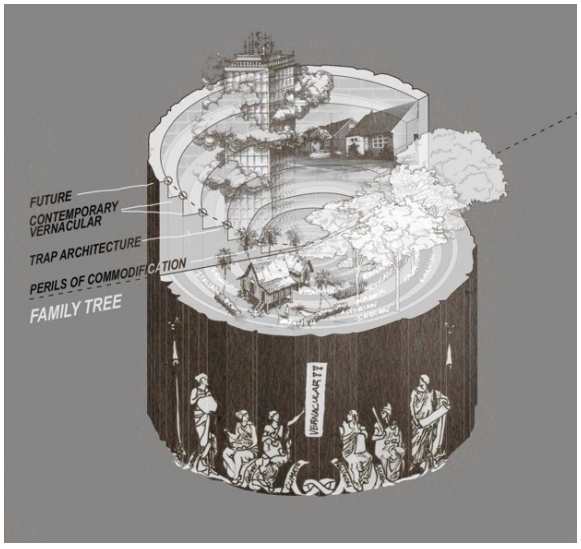


Figure 1. Diagram, Altamirano, Katerina, Cecilia Brock, Ben Edlavitch, and Henry Fernelius. Graduate Teaching Instructor Charlotte Pitts. Vernacular: Becoming Unstuck in Time. Fall 2023.

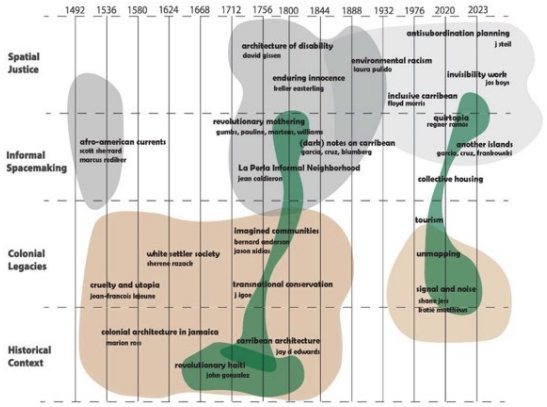


Figure 2. Diagram, Castillo, Lorena, Brian Lopez, and Emily Phan. Graduate Teaching Instructor Hayley Coolbaugh. Spatial Projects in the Caribbean Region. Fall 2023.

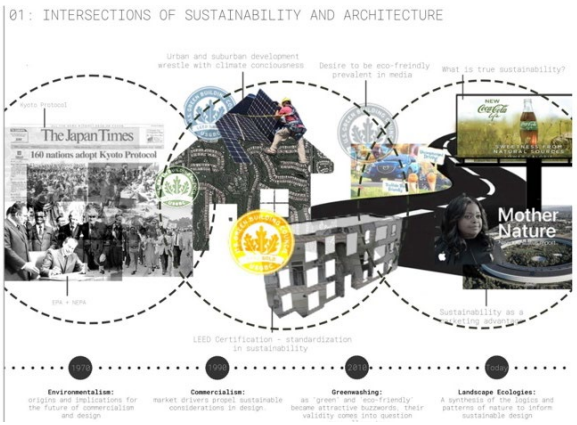


Figure 3. Diagram, Long, Stephanie, Miriam Shron, Sean Thiel, and Josie West. Graduate Teaching Instructor Charlotte Pitts. Intersections of Sustainability and Architecture. Fall 2023.

At the conclusion of the semester, group presentations transformed the classroom into a collective forum for reassessing the contours of architectural theory. As students presented their projects, they critically reflected on the course syllabus itself, comparing the fields they had developed through independent research with both the topics introduced by other project teams and those more formally addressed through lectures and assigned readings. This process made visible the partiality of any single syllabus and underscored the position that theory is a method, continually reshaped by new questions and forms of evidence.

The resulting discussions brought the semester to a close through collective reflection on how architectural theory is constructed, expanded, and revised. Students left with a heightened awareness that theoretical inquiry is not confined to a prescribed canon, but is something they can continue to pursue, question, and actively shape through their coursework and future design practice. Taken further, the cumulative outcomes of the project work, presentations, and class discussions have informed the ongoing refinement of the course's reading list and lecture content in subsequent iterations, reinforcing the course's position as an adaptive and responsive pedagogical framework.

CONCLUSION

The redesigned *Theories of Architecture* course responds to the paradox identified at the outset of this paper: the tension between architectural theory's historical role as disciplinary conscience and its frequent reduction to a detached, survey-based requirement. By teaching theory as an active, relational practice rather than a stabilized body of historical knowledge, the course repositions theoretical inquiry as a central method through which architecture interrogates its own assumptions and engages broader social, political, and environmental systems. Structured as an expanded field, the course balances disciplinary rigor with explicitly interdisciplinary inquiry, aligning theory pedagogy with the relational and systemic modes of thinking that increasingly shape architectural practice.

Students moved beyond consuming theory as content and participated in its ongoing production, learning to frame questions, evaluate sources, and map emerging discourses as integral components of architectural thinking. Equally significant, the project functioned as a feedback mechanism within the curriculum itself. The collective research, presentations, and discussions not only reshaped students' understanding of theory but also surfaced new themes, methods, and sources to be taken seriously as contributing to a contemporary field of references. Positioned in this way, architectural theory operates simultaneously as a pedagogical tool and a curricular process: a mode of critical inquiry that remains open to revision in response to changing conditions of practice. By treating theory as an open field shaped through collective investigation and critical negotiation, this approach offers a model for architectural pedagogy that restores theory's critical capacity while equipping students to navigate the complex spatial, ethical, and environmental challenges of 21st century architectural practice.

NOTES

[1.] An extensive discussion of the developments of architectural education in the American context, including the emergence and evolution of curriculum focused on History, Theory, and Criticism can be found in Joan Ockman's *Architecture School: Three Centuries of Educating Architects in North America.* Further assessments and critiques of architectural pedagogy and its support to the profession can also be found in Boyer and Mitgang (1996) and Tijerino (2009). These sources all provided critical insight for framing the development of architectural theory's position within design education discussed in the first sections of this paper.

[2.] For example critical theorists such as Michele Foucault (1977) and Fredrick Jameson (1972) considered spatial conditions within the development of their social theories.

[3.] Examples including the extensive writings of Manfredo Tafuri (1976) about the relationship between architectural history, criticism, and theory's role within the discipline as well as the architectural and urban theories of Aldo Rossi (1982) and his design practice.

[4.] Colin Rowe's seminal writing and approach to teaching history/theory have greatly influenced the pedagogy of architectural theory and design well into the 21st century.

[5.] Rosalind Krauss, "Sculpture in the Expanded Field," *October* 8 (Spring 1979): 30–44.

[6.] Douglas Crimp, "Appropriating Appropriation," in *Image Scavengers: Photography* (Philadelphia, PA: Institute of Contemporary Art University of Philadelphia, 1982), 33.

[7.] Examples include the ongoing work Diana Agrest (1991), Beatriz Colomina (1994, 2022), Peggy Deamer (2014), and such platforms as *Aggregate* and *e-flux*.

[8.] Dana Cuff, *Architectures of Spatial Justice* (Cambridge, Massachusetts: The MIT Press, 2023), 16.

[9.]. Douglas Crimp, "Appropriating Appropriation," in *Image Scavengers: Photography* (Philadelphia, PA: Institute of Contemporary Art University of Philadelphia, 1982),31-33.

[10.] Krauss' essay "Sculpture in the Expanded Field" was famously illustrated by a diagram which positioned landscape and architecture in relation to other practices distinctly "not landscape" and "not architecture", however highlighted shared tactics and concerns, demonstrating the interconnection rather than separation of these fields.

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A RAPID DESIGN METHOD IN THE INTERIOR ARCHITECTURE COMPREHENSIVE STUDIO

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INTRODUCTION

The Comprehensive Studio is an educational design studio, typically found in Architecture or Interior Architecture programs, that emphasizes integrating all aspects of a project, from conceptual design to documentation. This studio is more than just a technical course; it requires students to understand sociology, psychology, ergonomics, planning, materials and methods, detailing, sustainability, and the ability to visually communicate their ideas clearly in drawings to a third party, typically a contractor. No other course in our curriculum mimics professional practice as closely as the comprehensive studio does. A course so convoluted that it often hampers the design process due to excessive demands. This article discusses how the Rapid Design Method (RDM) has helped address this issue by enabling complex design solutions to operate in tandem with social and technical requirements, creating interdependence among all the themes covered in the course. This approach allows learners to make progress more quickly by viewing the process from a functional standpoint that incorporates a human-centered design approach, focusing on moments of social interaction and the interior environment necessary to fulfill them. This article speculates that the success of the RDM implemented in the comprehensive studio context is largely attributed to its ability to instigate creative flow. By presenting the RDM method in parallel with existing theories of creative flow, the article hopes to advance an understanding of how RDM has yield positive results in the context of the Comprehensive Studio.

THE COMPREHENSIVE STUDIO: AN OVERVIEW

The Comprehensive Studio serves as a way for the learner to consolidate all the knowledge accumulated through their undergraduate studies into a single project that covers sociology, psychology, ergonomics, planning, materials and methods, detailing, sustainability, and the ability to visually communicate their ideas clearly in drawings to a third party.[1] The process followed in the course is designed to mimic professional practice, producing the learner's first set of drawings in their design career. Typically, the set will cover, to some degree, the first three phases of a five-phase design process (Schematic Design, Design Development, Construction Documents, Bidding Process, and Construction Administration).[2] In this course, the learners will work in groups of two and will be graded in terms of seven assignments with different grade weights each. The first assignment (A1-10% of the total grade) is due at the beginning of the second week and is graded individually. In this

assignment, learners will research and present a case study related to the project they are about to undertake. The second assignment (B1-5% of the total grade) begins at this point and involves a sketchbook where students must document their process; only ideas explored in the sketchbook are discussed during the desk-crits. Assignment A2 (5% of the total grade) will take place in week 4 and will consist of a review focusing on planning, circulation, and human-centric design, reviewed by in-house professors. Assignment B2 (5% of the total grade), titled Firm Identity, will be due in week five and involves graphic elements for the title block and drawing graphics. This assignment is connected to the Professional Practice course. Assignment A3 (20% of the total grade) will follow in week eight and will be an online gallery review, during which learners will be exposed to international reviewers. Each team meets with three reviewers at different times, receiving multiple ideas and opinions to filter and interpret before their final review. Assignment B3 (15% of the total grade) allows learners to further detail one of their design elements by creating a more developed drawing subset of a given interior element. And finally, assignment A4 (30% of the total grade), which serves as the final review. In Figure 1, you can see the amount of work produced in this course for final review.

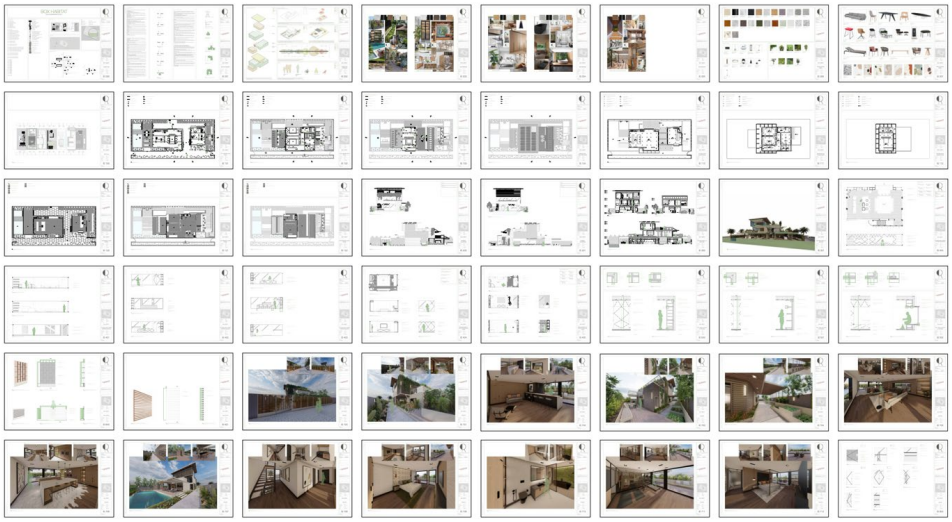


Figure 1. Sample of a typical Comprehensive studio final requirements, produced by fourth-year learner, Rajaa Muaz Taye. Drawings are set up on A2 pages. The image shows the amount of work a learner produces in the course.

To meet accreditation requirements, this course intentionally covers a wide range of elements to reduce the load on other studio courses, allowing them to focus more on the design process. This makes Comprehensive Studio so convoluted that it can hinder the design process because of the excessive demands placed on it. In a typical Comprehensive Studio, learners are encouraged to pause the design process at a certain point (usually by week 6) to develop, detail, delineate, and better integrate and resolve their work. We don't do this in the Interior Architecture program, which allows learners to keep designing until week 12. We can accomplish this by using the Rapid Design Method, which will be discussed later in this article. Another critical aspect of the process involves the nature of geometry and complexity; learners are advised to limit formalisms to simplify and better resolve the functionality and buildability of their work. For both of these, the Rapid Design Method is highly effective because it covers an ergonomic, code-focused, human-centered design approach. Unlike a typical studio's design process, Rapid Design delivers a functional result from the beginning, making it a very efficient design method in the complex realm of the Comprehensive Studio.

THE RAPID DESIGN METHOD

A large project site can be overwhelming to many design learners. It can be assumed that design learners will face a new scale requirement in each studio, as design studio sequences exponentially increase project sizes. This results in many design learners being unable to visualize the site's actual size. This scaling up also runs in parallel with the functional and programmatic piling up that learners encounter in a typical design studio sequence. All these seemingly basic requirements are added to the expectation of an overarching theoretical concept that frames all aspects of the design output. The cumulative effect of these factors often leads to stagnation in design activity, which may cause paralysis and demotivation.

Rapid Design Method (RDM) is conceived as a process that directs and multiplies design activities in rapid succession, enabling a design student to work through complex interactions between scales, functions, and programmatic requirements. RDM removes the burden of having an articulated design theory, concept, or high-level intent before starting the design process. Instead, RDM proposes that through engaging in continuous, sustained design activities, students are better equipped to formulate self-directed design theory and concepts.

The core principle of RDM is to make design decisions at the scale of the human body, starting from a first-person perspective. Guided by two types of consecutive prompts, social interaction and functional iteration, design decisions are focused on resulting in the design of a spatial node that measures up to the limit of a body's sensory range. The clarity of what the programmed space is will emerge as the designed spatial nodes are continually added. With each articulation of a node, learners are asked to re-evaluate the design decisions made in prior nodes, enabling an iterative cycle that gives opportunities to build up controlled complexities, as seen in Figure 2.

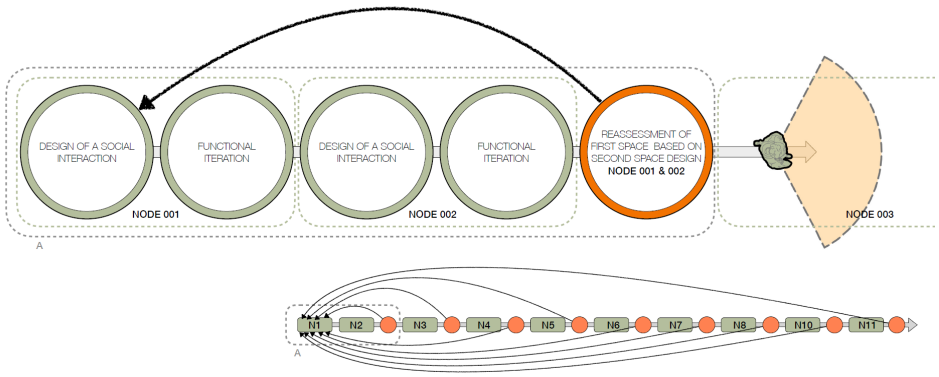


Figure 2. Diagram illustrating the continual assessments of Nodes in green to produce rapidly developed Iterations in orange.

The collection of spatial nodes unfolds into the forms of a programmed space. Figure 3 illustrates an example of designing an entry space for a photography studio. The series of drawings showcases the development of the entry space through Iterations. The two types of prompts used to scaffold the student's development for this particular example are listed in Table 1. Students are given one minute to implement their design decisions after each prompt. The assigned time establishes continuous design activities, allowing students to experience consistent pacing.

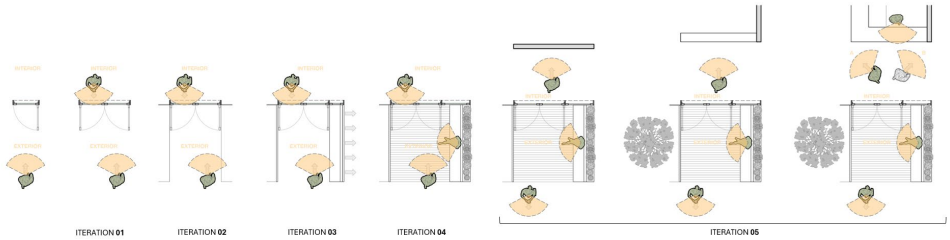


Figure 3. A series of drawings that illustrate the sequential Iteration development of the entry space.

Node	Interaction Prompt	Functional Prompt
1	You are to enter through doors into the studio. Draw what type of doors this maybe?	There maybe others trying to enter or exit through the same door. What type of door and how wide should they be?
2	How would you best be guided to the door? Draw what spatial element may do that?	What minimum required dimension does this spatial element need to be to accommodate movement?
3	You are early to meet a friend for your photo appointment; and you like to wait for her at the entry. What spatial element will help you be more comfortable?	What minimum required dimension does this spatial element need to be to accommodate your activities?
4	It seems the wait is much longer than anticipated. What other spatial elements and materiality may you implement to create a more pleasing experience?	What are the ideal dimensions and materiality these spatial elements need to be to accommodate your activities?
5	This is the first time you and your friend are visiting the building, as you walked in through the doors, what spatial elements may be needed to greet you?	What is the placement and characteristics of this spatial element that most effectively help you navigate the photograph studio?

Table 1. List of Interactive and Functional prompts used to scaffold the development of Iterations.

In this example, the photography studio's entry is considered a "micro program," a part of the larger project site of the photography studio building. The sequential and systematic development of a project is achieved through the accumulation of these micro-programs, as seen in Figure 4.

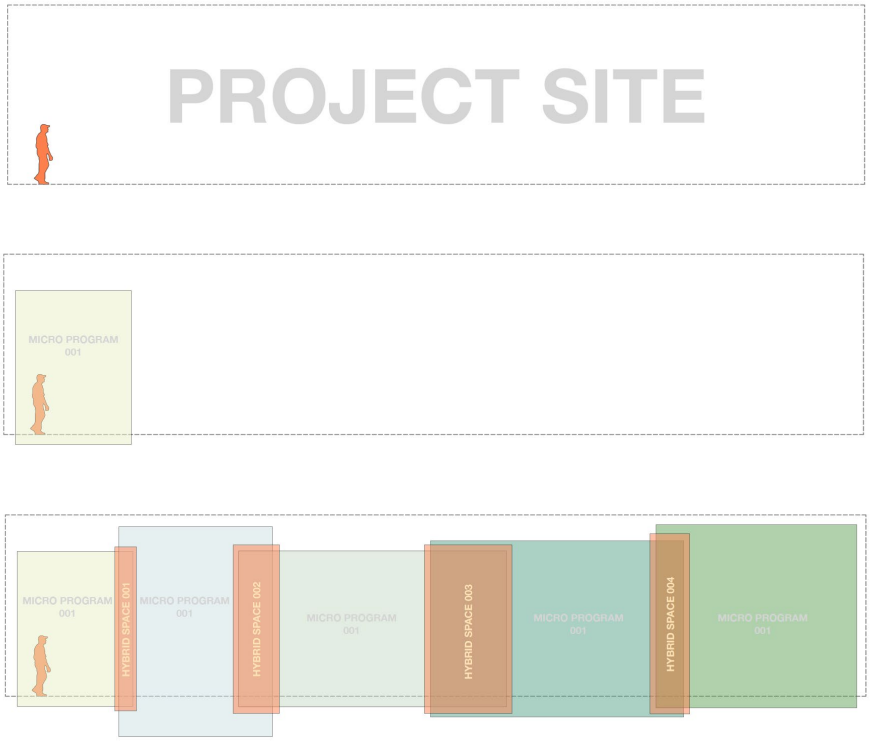


Figure 4. Accumulation of micro programs and their in-between spaces develop into the Project.

CREATIVE FLOW, A RESULT OF DESIGN WORK IMMERSION

Creative flow is a mental state of deep immersion and single-pointed focus on a creative activity, often referred to as being "in the zone" by athletes or “mindfulness” by meditators. In this state of mind, people experience a smooth connection between their actions and thoughts, where time seems to disappear, self-awareness fades, and creativity flows effortlessly. A state of complete absorption, where the only thing that matters is the work itself. A state devoid of distraction.

Research on the flow state has its origins in positive psychology, emerging first in studies of the psychology of happiness. The term “flow” was first introduced in 1975 by psychologist Dr. Mihaly Csikszentmihalyi, whose work influenced the understanding of the relationship between creativity and focus.[3] He described “flow” as a highly focused mental state in which individuals are completely immersed in an activity, often losing track of time and external concerns.[4] This theory suggests that when we are fully focused and engaged in the present moment, we enter a state of flow and become intrinsically motivated by neurochemical releases in the brain, finding the activity rewarding simply by doing it, rather than solely focusing on the potential rewards upon completion.[5]

Creative flow has been shown to enhance problem-solving abilities, elevate mood, and even strengthen neural connections related to creativity. Because of the positive effects associated with “creative flow”, this state is considered an optimal experience. For a designer, working in this state of mind guarantees enjoyment of the process, turning even the most banal design assignment into an opportunity rather than a problem.

ENTERING A STATE OF CREATIVE FLOW

"*Being completely involved in an activity for its own sake. The ego falls away. Time flies. Every action, movement, and thought follows inevitably from the previous one...Your whole being is involved, and you're using your skills to the utmost.*" *Dr. Mihaly Csikszentmihalyi* [6]

Flow is a state of being that requires us to focus our thinking and attention entirely on an activity that brings us joy and fulfillment. We become so absorbed that we lose track of time because our mind, body, and senses are entirely engaged. Just like in meditation, sports, or Yoga practice, Creative Flow emerges when the mind is both challenged and single-pointedly absorbed in a task. This state can be reached when attention is undivided, and the activity resonates personally. It is a skill that can be developed through practice and habituation, leading to a deeper, more meaningful connection with our work. The process allows the learner to move beyond self-consciousness to a place where ideas flow freely, challenges are met with curiosity, and the present moment becomes a space for exploration and discovery. In meditative practices like Buddhism, this process of awareness and nonjudgmental acceptance of one's moment-to-moment experience is called mindfulness.[7] On a TED talk in 2004, Csikszentmihalyi described the process as follows: "There's this focus that, once it becomes intense, leads to a sense of ecstasy, a sense of clarity: you know exactly what you want to do from one moment to the other; you get immediate feedback. You know that what you need to do is possible, even though it's difficult, and the sense of time disappears; you forget yourself, you feel part of something larger. And once the conditions are present, what you are doing becomes worth doing for its own sake."[8]



Figure 2. Creative Flow Process, according to Dr. Mihaly Csikszentmihalyi, based on a diagram by Anne-Laure Le Cunff, presented in her article entitled "The 5 pillars of creative flow."

To enter a state of creative flow (Figure 2), the learner needs to engage in an activity she/he finds meaningful (in our case, designing). In a space that helps avoid distractions and interruptions. It should be a challenging task that stimulates the learner without overwhelming them, keeps them focused, and ensures they feel confident in their ability to succeed. This is because we are more likely to enter the state of flow when engaged in tasks we've already practiced. The iterative nature of the design process is ideal for this purpose. The idea is that the learner enters an autopilot state, without overthinking each decision, and simply designs through a series of iterations that feed the Creative Flow. This is why distraction should be avoided, which begins with streamlining the workflow. You need to have all the tools you need with you, so you don't get distracted or interrupt the workflow. This extends to your environment. The state of creative flow is a kind of meditation and can be disrupted by a lack of focus or distractions.[9] Breathing exercises reduce stress and improve concentration, creating a conducive mental state for creative flow. Developing single-pointed concentration (being in the present moment) by redirecting your thoughts to the task at hand when your mind wanders will strengthen your ability to stay in a state of creative flow. This mindful work through repetition also helps you remain in that flow for longer.

FUTURE DIRECTION

At first glance, the workings of the Rapid Design Method track well with the theories of creative flow and provide a possible explanation for the method's capacity to enhance productivity in the context of the Comprehensive Studio. The pairing also serves a much more vital purpose: Creative flow connects learners to their craft by enabling ideas to surface effortlessly, so that each iteration is approached with curiosity, turning problems into opportunities for exploration and discovery. The process can then create an addictive routine because it produces a feeling of joy and contentment through the

release of neurochemicals like serotonin and dopamine in the human brain. The learner leaves the experience feeling ecstasy, and because of this outcome, is eager to repeat it. A process experienced and well-documented in meditation. The opportunity to develop creative flow usually arises at the end of the semester, when students have been consistently immersed in their craft. This is where a semester of iteration using the Rapid Design Method can help some students reach a state of creative flow.

This pairing of RDM with Creative Flow theories provides insights to improve future articulation of RDM. As the design method originated from experimentations in teaching within the specific particularities of the Comprehensive Studios, it can benefit from this speculation, providing a framework for future development and testing.

CONCLUSION

The introduction of the Rapid Design Method (RDM) in the Comprehensive Studio has improved the overall quality of the studio's work. It is observed that learners who understand the process well enough to trigger "Creative Flow" have turned the design process into a game, where the goal is a never-ending exercise of design iterations that evolve their ideas with each iteration. Such procedural understandings are often visible on their facial expressions, and when that happens, the faculty can stop handholding them. This usually makes up 20% of the studio. For the majority, 60% of the group will have tried using RDM with mixed results. It is observed that learners who didn't implement RDM in its full capacity are able to move through design decisions, production, and detailing at a pace that surpasses their typical capacities and performance. While the design projects of this group of students remain more formal than functional, their projects demonstrated a much more developed understanding of ergonomics, code implementation, and human-centric design. The remaining 20% of the studio was unable to implement the method and reverted to their default design process, resulting in underdeveloped projects. More work is needed to systematically introduce RDM within a Comprehensive Studio context. Along with appropriate quantitative and qualitative methods for collecting data, we can gain new insights into how RDM can train independent designers who can deliver complex architectural solutions that meet diverse project requirements.

NOTES

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BEYOND ACCESSIBILITY: EMERGING PRACTICES OF HUMAN-CENTERED DESIGN LEARNING

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INTRODUCTION

In 2009, as an undergraduate student at the University of Maryland School of Architecture, I had the opportunity to work closely with the National Federation of the Blind (NFB), to co-organize the first-ever architecture program for individuals with vision-impairment. This experience cemented my commitment as a non-disabled ally–to advocate for disability representation and awareness in design practice and education.[1] Today, as an Assistant Professor at the Virginia Tech School of Architecture, I regularly collaborate with local, state, and national organizations employing and serving individuals with disability to provide our students with a more inclusive education.

This paper outlines the pedagogical method I've deployed in my workshops, architecture studio projects, and research seminars to address some of the challenges and opportunities of engaging in human-centered design teaching. It elaborates, in particular, on three key strategies: 1) centering design projects which address accessible space-making on the lived experience of disability;[2] 2) incorporating hands-on engagements with assistive devices, technologies, and the infrastructure of disability; and 3) supporting the exploration of inclusive design beyond code-compliance.

LIVED EXPERIENCE

Essential to effectively teaching about the challenges and opportunities of human-centered design is the systematic inclusion of individuals with disability. In addition to engaging my students with relevant printed and digital reference materials about alternative sensory perspectives and methods for interacting with the built environment, including online blogs and videos,[3] I organize interactive meetings and workshop sessions with disabled practitioners and leadership of community groups to facilitate participatory and "responsive [learning] methods that build on… lived experiences and contexts."[4]

Over the past five years, since the fall of 2021, I have collaborated with the Virginia Department for the Blind and Vision Impaired (DBVI), one of Virginia's two vocational rehabilitation agencies,[5] to organize orientation and mobility (O+M) training session for students of architecture who are challenged to design for individuals with vision impairment; these students could be engaging in a hypothetical project in my second-year undergraduate architecture studio, undertaking design-builds in my research seminars, or preparing the learning program for our School's annual Blind Design Workshop.[6] DBVI staff members give instruction in disability etiquette, tactile communication methods, and digital aids, and lead an interactive Q+A session during which instructors elaborate on and address questions about their experience with vision-impairment [Figure 1].



Figure 1. Demonstration of tactile teaching methods and digital aids.

Similarly, I have worked with blind performance artist, Davian (DJ) Robinson, to organize a more creatively-formatted method for conveying a non-visual perspective of space. DJ leads a 2-hour, immersive dance workshop at Virginia Tech's black box theater (the "Cube" at the Moss Arts Center) which challenges architecture students to move and interact while blindfolded. In one exercise, DJ prepares a tactile diagram of an abstract shape which the students must read non-visually then recreate with their bodies [Figure 2]. Additional activities include exercises in echo-location, sound-source identification, and interpretative dance, followed by group discussion. The workshop's aim is to help participating architecture and design students "foster a deeper understanding of body awareness through the elimination of sight."[7]

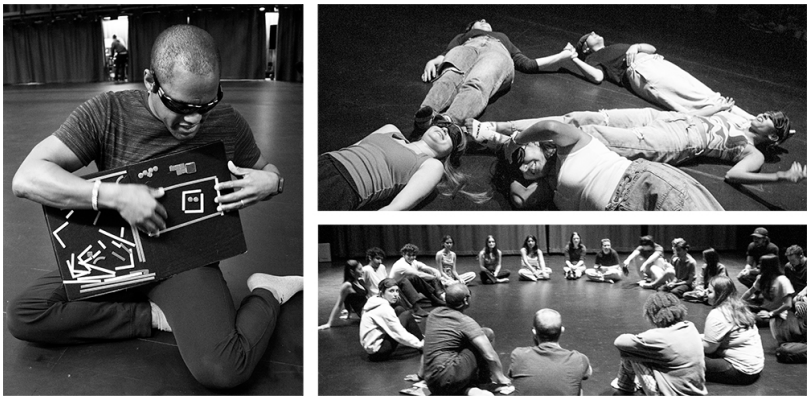


Figure 2. "Sensory Beyond Sight" dance workshop led by Davian (DJ) Robinson.

In addition to workshop sessions, I invite creative professionals with disability to give regular feedback on in-process student design projects and serve as point-people for the duration. To take one example, one of my second-year studio projects challenges students to design a nature observatory for visitors of the Burkeville Lodge for the Blind in Burkeville, VA;[8] it begins with the aforementioned O+M training led by DBVI; students dialogue with visiting critics with vision-impairment, half-way through the project; then, finally, they present their work with accessible, multi-sensory deliverables to sighted and vision-impaired members of the Lodge. The benefits of this learning process are especially evident in the quality of student design proposals. When making tactile models, for example, students commit to and develop clear ideas about parti (referring to a project's core idea or organizing principle) to maintain the non-visual comprehensibility of their designs; each project is particularly attentive to structure and materiality; and proposals for accessible, multi-sensory building details are especially innovative and thought-provoking [Figure 3].

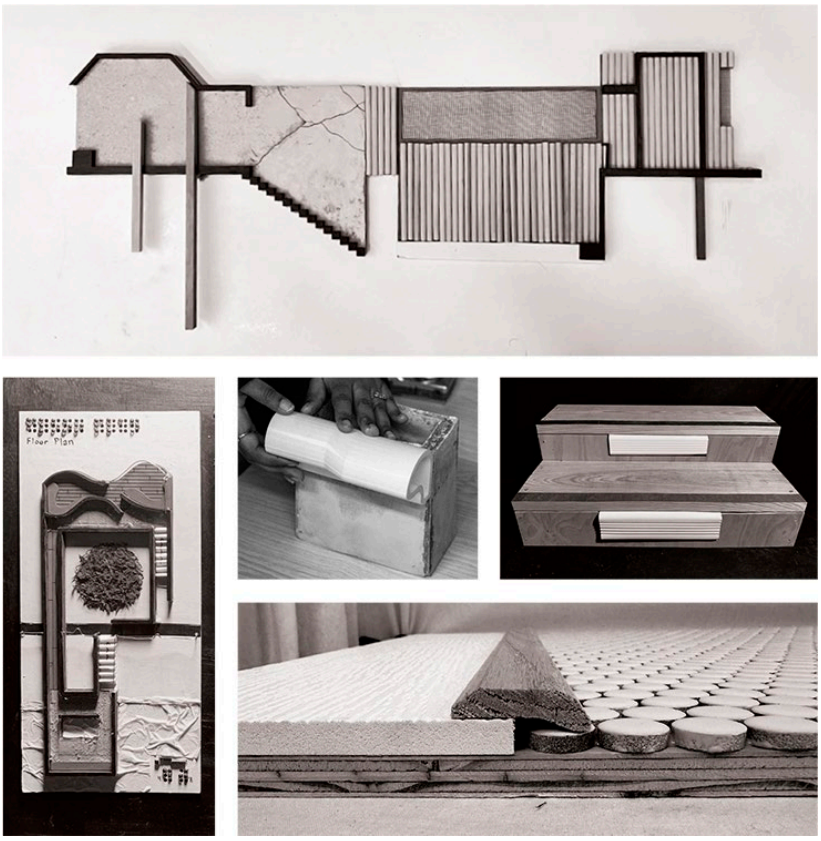


Figure 3. Student design work, including a tactile section diagram (top) and floor plan (left), railing prototype with indicative bump-out (middle), a stair which playfully reinforces proper cane usage (i.e. tapping the risers as you ascend) by creating music (middle, right), and an ADA-compliant floor detail rendering perceptible the separation between two interior spaces (bottom).

DISABILITY SIMULATION

The learning method presented here also includes exercises which engage students with the mechanical aspects of disability and assistive devices, as a means of initiating dialogue with and facilitating understanding of alternative sensory perspectives and modes of interacting with the built environment. During their training session with DBVI, for example, students are guided through a series of orientation and mobility exercises using a white cane in and around Cowgill Hall (Virginia Tech's architecture building) while wearing custom goggles that functionally approximate total blindness, tunnel vision, loss of central vision, and blurred sight [Figure 4]. This experience, which DBVI conventionally organizes for family members of individuals with vision-impairment, is intended to introduce the functional challenges of spatial mobility and design communication with limited or no vision.



Figure 4. Orientation and mobility training session led by DBVI.

I have also collaborated with leadership of the Foundation for Rehabilitation Equipment and Endowment (or the F.R.E.E. Foundation) and the Universal Design (UD) Project to provide hands-on training about wheelchair use. F.R.E.E. is a non-profit organization based in the state of Virginia which provides refurbished mobility devices to low-income citizens at no cost;[9] and the UD Project is a collaboration service for new construction which is led by Scott Pruett, an accessibility consultant and wheelchair user, and Sarah Pruett, an occupational therapist.[10] In the fall of 2025, both organizations worked together to deliver a presentation about mobility devices and accessible / inaccessible infrastructure. This was followed by an interactive "roll-about" across campus which challenged students to use ADA-compliant doors, ramps, and elevators, and non-compliant infrastructure, like the steeply-graded access road to the Architecture School's first-floor accessible entrance, which demanded intense physical effort [Figure 5].



Figure 5. Interactive wheelchair exercise led by Scott Pruett of the UD Project.

There is some contention that irrespective of the exercise's framing or intent and who leads it, any kind of functional imitation of disability risks conveying negative perspectives–promoting exclusion and pity,[11] validating the "plight of the disabled."[12] While I acknowledge that superficial and naïve misconceptions like these are possible, I have yet to encounter them among my own students / have no immediate evidence that the risk of provoking them outweighs the benefits of the engagement. On the contrary, I would suggest that these engagements are an appropriate context for misconceptions to be meaningfully addressed. Here, I am in agreement with Dr. David Legg, Professor of Sport Management and Adapted Physical Activity at Mount Royal University in Calgary, Alberta, Canada, whose students spend a day in a wheelchair to better understand accessibility from a mobility perspective.[13] The oft-cited "Crip for a Day" study similarly suggests "test[ing] mobility equipment to identify environmental barriers and ableist reactions" and "communicating with people living and working with various impairments" to understand the creative solutions they've discovered;[14] and the more recent "Teaching Accessible Space in Architectural Education" study lists "deeper connections" to disability-related issues and "raise[d] awareness of less visible barriers" among the foremost outcomes of learning about architecture from experts with disability.[15]

That these activities are organized for rising architects is also an important consideration: 1) architecture is a profession of full-body experience, which is trained for through years of immersive engagement / hands-on learning; and 2) international building codes require architects to design accessible, public spaces specifically for wheelchair users and individuals who are vision-impaired, regardless of whether their project has allocated funding and time to engage directly with the disability community. All of this to say that if an architect finds themselves in the likely scenario of designing a space which must accommodate the turning radius of a wheelchair, without immediate access to a wheelchair user, to not sit in / move around in one because it might be misperceived as an attempt to simulate lived disability experience promotes a level of social caution which perpetuates, rather than challenges, the passive apathy of non-disabled individuals towards the experiences of individuals with disability (in the architect's case, through inert compliance rather than creative engagement with standards for access).[16]

I don't believe that the lived experience of disability should (or even can) be simulated; empathy and understanding about disability should *firstly* be cultivated in dialogue with individuals who have lived experience. And it's for this reason that the learning objectives of the aforementioned activities do not extend beyond the physical mechanics of the disability being designed for (i.e. more broadly, to disability experience or identity); and why they are *always* organized with and led by individuals with lived disability experience who are in a position to address the inextricable association of these mechanics with disability identity and experience.

About his experience designing for and working with individuals with vision-impairment during the 2022 and 2023 Blind Design Workshops, one student wrote: "[It] was a fascinating opportunity for me to challenge, refine, and articulate my understanding of disability as it relates to architecture. As a hard-of-hearing person, I found myself relating to their perspectives and comparing them to the challenges I experience as a student with a disability. For me, interacting with the blind community wasn't a grandiose realization that other senses indeed matter. It was, instead, an opportunity to reflect more broadly on how we can eliminate barriers for people with disabilities entering the profession of architecture, and how valuable the experiential knowledge of people with disabilities is to our understanding of design."

BEYOND ACCESSIBILITY

Finally, my teaching supports the exploration of inclusive design beyond bare-minimum code-compliance.[17] Students begin their projects with a critical review of relevant regulations,[18] but are challenged to explore proposals which are both code-compliant *and* creatively beneficial to a broader constituency of user groups.[19] I also try to focus project design prompts on individual building elements (i.e. the design of a stair, ramp, handrail, etc.) rather than a *type* of accessible space or building, to facilitate the gradual familiarization with what can otherwise be perceived as an overwhelmingly complex domain.

This beyond-accessible approach informed my recent "AI-Accessibility" research seminar in which students reimagined accessible, non-visual interaction with public space using emerging fabrication techniques and AI. With internal funding from the Virginia Tech Institute for Creativity, Arts, and Technology (or ICAT) and support from faculty and students of Architecture, Computer Science, Human Sciences, and Marketing,[20] I organized and instructed two undergraduate research seminars involving more than 35 graduate and undergraduate students in the 2024-2025 academic year, to prepare an immersive, on-campus exhibition at the Cube. The exhibition, which was supported by on-site mobility training by the Virginia Department for the Blind and Vision Impaired (DBVI), gave attendees the opportunity to interact with five re-designed spaces while using a white cane blindfolded. These included a residential threshold, hospital hallway, retail outlet, sidewalk-crosswalk, and museum, which were selected based on focus group feedback about the most challenging spaces for individuals with vision impairment [Figure 6].

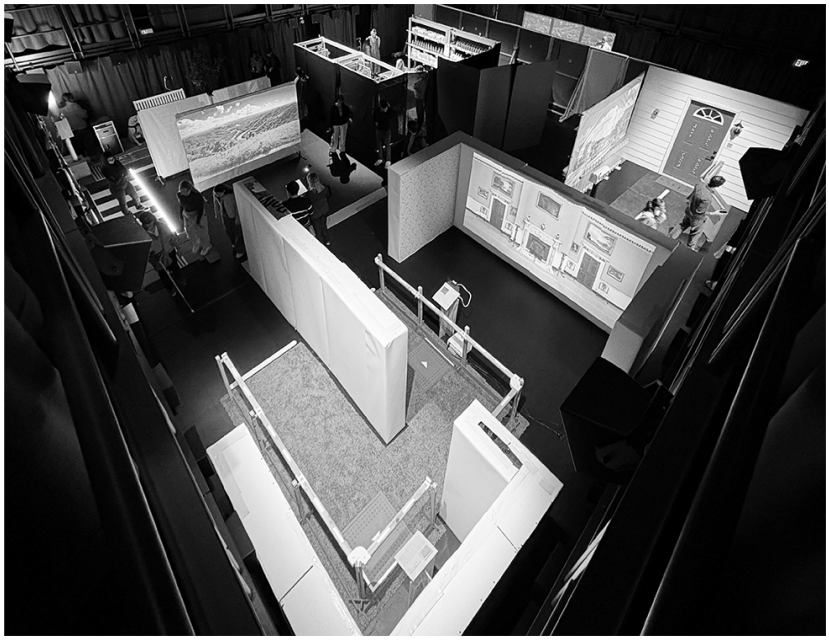


Figure 6. Overhead view of the AI-Accessibility exhibition, showing the museum (foreground), residential threshold (right, mid-ground), sidewalk-crosswalk (left, mid-ground), retail outlet (center, background), and hospital hallway (right, background).

The residential threshold introduced attendees to a system of live QR codes which provided navigation instructions and spatial descriptions throughout the exhibition. The threshold itself was accessed by a tactile guide strip adjacent to a handrail with musical tiles embedded in its base (so that the pitch increased as you tapped them with a cane / approached the door) [Figure 7]. The hospital hallway challenged attendees to find the correct patient room door by reading 3D-printed tactile

signage and featured AI-generated landscape projections and guide strips. The retail outlet challenged attendees to find a grocery item and clothing product using any combination of 3D-printed shelving indicators and QR codes. The sidewalk-crosswalk exhibit included QR-code sidewalk tiles for information about the space and a hands-free AI-information station which enabled wayfarers to dialogue about an urban scene, before continuing to an illuminated crosswalk. And the museum space likewise included AI-info stations, and showcased a smart handrail system which looped its way through the exhibit, providing both tactile cues and QR-code navigation instructions [Figure 8].



Figure 7. Attendees use a white cane and tactile path to navigate towards the door.

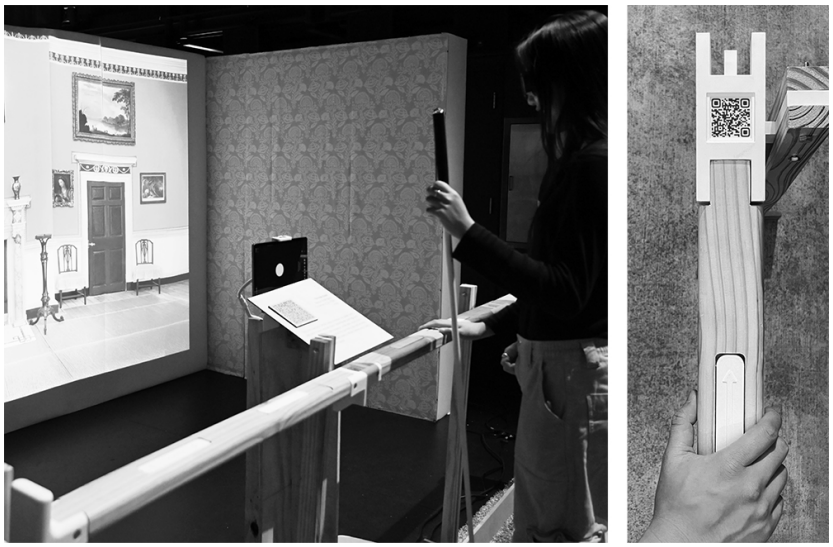


Figure 8. AI-info station (left) and a smart handrail system (right) facilitate accessible and intuitive interactions with simulated museum exhibits.

This project highlights another important aspect of the teaching method here presented, which is to carry design projects from concept to completion at some scale of design-build. The same "AI-Accessibility" project team also had the opportunity to permanently deploy a number of the exhibited building elements at the Burkeville Lodge for the Blind in Burkeville, VA, to improve the safety,

accessibility, and sensory engagement of a newly-proposed memory garden space. In addition to a canopy, trellis walls, and planter boxes to better-enclose the space, students created tactile handrail additions and 3D-printed QR codes to convey directional instructions and information about the Lodge [Figure 9]. One of the team's student leaders reflected about his design-build experience, writing: "Looking back, I feel very grateful for the experience, especially for [Dr. Gipe-Lazarou's] guidance which helped me understand key principles around accessibility, such as tactile cues, details, and navigation design. I didn't expect to enjoy cutting wood and hammering nails, but the design-build process was so engaging. It helped me grow not just in design thinking but in navigating complex human dynamics that surround creative work, especially in contexts as emotionally sensitive and ethically urgent as disability design."



Figure 9. Student design installations at the Burkeville Lodge for the Blind.

SUMMARY

In summary, the allied method of human-centered design pedagogy which informs my work:

- Centers design projects which address accessible space-making on the lived experience of disability by facilitating dialogue between students and representatives of the constituencies they're designing for;
- Incorporates 'hands-on' engagements with assistive technology, devices, and the physical mechanics of disability which are organized with and led by individuals with lived disability experience; and
- Supports the exploration of inclusive design and inclusive design learning beyond accessibility by familiarizing students with relevant conventions, then encouraging hypothetical and real / built experimentation.

NOTES

[1] I have previously written about my collaboration with the NFB and subsequent efforts to advance disability representation in architecture, including the organization of the Blind Design Workshop (briefly described in the note below). See Andrew Gipe-Lazarou, “Accessing architecture: Career exploration opportunities for aspiring designers with vision impairment,” Design Studies 99 (2025), doi: 101317.

[2] With the term “lived experience”, I am referring not only to the physical mechanics of disability, but also and primarily to “the cumulative social and psychological effect of encountering social and physical barriers over a lifetime.” See Sally French, “Simulation Exercises in Disability Awareness Training: A Critique,” *Disability, Handicap & Society* 7, no. 3 (1992): 257–266.

[3] Here referring to “public disability representations” created and presented by individuals with disability about the lived disability experience. See Iva Strnadová, Michelle L. S. Tait, Joanne Danker, Carolyn M. Blackburn, and Julia Whitburn, “Lived Experiences of Public Disability Representations: A Scoping Review,” Journal of Public Health and Emergency 5, no. 2 (2023): 38, https://www.mdpi.com/2673-7272/5/2/38.

[4] Elise Hodson, Annukka Svanda, and Nastaran Dadashi, “Whom Do We Include and When? Participatory Design with Vulnerable Groups,” CoDesign 19, no. 4 (2023): 269–86, https://doi.org/10.1080/15710882.2022.2160464.

[5] A vocational rehabilitation (or “VR”) agency is a government or non-profit organization that helps peoples with disabilities prepare for, find, and maintain employment. Under federal law, every U.S. state is required to have a VR agency, and they are typically organized as either one combined VR agency or else two separate agencies, one serving individuals who are blind and visually impaired and the other serving individuals with other disabilities. There are a total of 78 vocational rehabilitation (VR) agencies in the U.S.: 56 general / combined and 22 specifically for individuals who are blind or visually impaired.

[6] The Blind Design Workshop is an architectural learning opportunity for individuals with vision impairment, which I’ve organized each spring in collaboration with the Department for the Blind and Vision Impaired (or DBVI) since 2022. The five-day workshop is prepared by architecture and interior design students whose prompt is to instruct the architectural design process in a non-visual way. It takes place at the university’s main campus in Blacksburg, VA, and hosts 15 participants between the ages of 16 to 24, with varying types and degrees of vision-impairment.

[7] Davian (DJ) Robinson, “Dance,” Empower23, accessed July 12, 2025, https://www.empower23.net/dance.

[8] The Lodge is a vacation destination located in a forested small town of central Virginia. It was established in 1960 by the Virginia Association of Workers for the Blind and designed with accessible accommodations, including a stainless steel guiderail which connects the Lodge’s circumferential walkway to a network of paved nature trails. For more information, visit: https://vawb.org/about.html.

[9] For more information about F.R.E.E., visit: https://www.free-foundation.org/.

[10] For more information about the UD Project, visit: https://universaldesign.org/about.

[11] Jody Yarborough, “Simulation Exercises Are Outdated and Damaging to the Disability Community,” Love Disabled Life (blog), October 2, 2017, https://www.lovedisabledlife.com/blog/simulation-exercises-are-outdated-and-damaging-to-the-disability-community.

[12] Jeff Preston, “The Problem with ‘Spend a Day in a Wheelchair,’” Jeff Preston (blog), September 1, 2014, https://jeffpreston.ca/2014/09/01/problem-disability-simulation/.

[13] John Loeppky, “Disability Simulations: Harmful or Enlightening?,” Accessibility.com (blog), December 17, 2020, https://www.accessibility.com/blog/disability-simulations-harmful-or-enlightening.

[14] Nario-Redmond, Michelle R., Dobromir Gospodinov, and Angela Cobb. 2017. “Crip for a Day: The Unintended Negative Consequences of Disability Simulations.” Rehabilitation Psychology 62, no. 3: 324–33. https://doi.org/10.1037/rep0000127.

[15] Bonenberg, Agata, and Barbara Linowiecka. 2025. “Teaching Accessible Space in Architectural Education: Comparison of the Effectiveness of Simulated Disability Training and Expert-Led Methods.” Education Sciences 15, no. 3: 391. https://doi.org/10.3390/educsci15030391.

[16] Passive disability attitudes which perpetuate “implicit ableism” are notably described / elaborated on in Friedman, C. & Owen, A., (2017) “Defining Disability: Understandings of and Attitudes Towards Ableism and Disability”, Disability Studies Quarterly 37(1). doi: https://doi.org/10.18061/dsq.v37i1.5061.

[17] Sara Hendren, quoted by Jos Boys, emphasizes this challenge of architectural practice: “I think the biggest barrier, of course, is the limited imagination that standards tend to create. Because it’s a checklist and a liability matter, the rhetorical framing of disability gets subsumed under that logic: a cloud over the excitement of a project, or a ‘don’t forget’ matter of inclusion.” See Jos Boys, “Designing for Disability Justice: On the Need to Take a Variety of Human Bodies into Account,” *Harvard Graduate School of Design*, February 2021,

https://www.gsd.harvard.edu/2021/02/designing-for-disability-justice-on-the-need-to-take-a-variety-of-human-bodies-into-account/.

[18] Referring, as of writing, to the 2017 ICC A117.1 Accessible and Usable Buildings and Facilities (Washington, DC: International Code Council, 2017), https://codes.iccsafe.org/.

[19] As noteworthy examples, I often refer to the seating area beneath the grand staircase of the San Francisco Lighthouse for the Blind (which makes creative use of a cane-detectable barrier) and the dumpster ramp at the Shinsei Gardens housing project (which helps wheelchair users *and* children to take out the trash). See, respectively, "Lighthouse for the Blind and Visually Impaired," Cavagnero, accessed July 13, 2025, https://www.cavagnero.com/project/lighthouse-for-the-blind-and-visually-impaired/; and Mikiten Architecture, "Shinsei Gardens - Alameda," accessed July 13, 2025, https://www.mikitenarch.com/shinsei-gardens---alameda.html.

[20] For more information about this internally-funded research and the team making it possible, please visit the project's webpage at: https://arch.vt.edu/experiential-learning/research-and-creative-scholarship/ai-accessibility.html.

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SLOW-LEARNING FAST-LEARNING, HOW TO INTEGRATE AI AND EMERGING TECHNOLOGIES INTO DESIGN

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INTRODUCTION

We are amid a technological paradigm shift that is fundamentally reshaping the boundaries of architecture, design, and education. The integration of technologies such as Artificial Intelligence (AI), Virtual Learning Environments (VLEs), and Extended Reality (XR) is blending reality with computer-generated information, creating new dimensions of design and experience.[1] From a pedagogical perspective, this integration represents a necessary evolution from traditional, master-apprentice models towards more interactive, engaging, and critically-engaged approaches.

However, the adoption of these technologies, particularly AI, is often met with a binary response: either wholesale, uncritical embrace or defensive resistance. This paper argues that both positions are pedagogically insufficient. The challenge is not to choose between speed and deliberation, but to pedagogically orchestrate them. The core research question is: How can architectural education structure the integration of AI to cultivate both the agile, experimental fluency required by new technologies and the deep, critical, and reflective intelligence that defines the discipline?

This study explores a dual-track model, framing the integration through the temporal lenses of Fast-Learning and Slow-Learning. We situate the "Fast" mode in the context of the extracurricular workshop, as demonstrated in the structured, generative AI frameworks of Longo.[2] Here, speed is pedagogical, enabling rapid iteration and pattern recognition. We contrast this with the "Slow" mode, embodied in the semester-long studio, as theorized by Dall'Asta,[3] where AI becomes a conversational partner in a prolonged process of critical interrogation and contextualization.

Through a synthesis of these authors' works and supporting contemporary literature, this paper will delineate the theoretical underpinnings, methodological frameworks, and complementary outcomes of this temporally-differentiated pedagogy, proposing it as a robust model for the future of architectural education.

THEORETICAL BACKROUND

The New Pedagogical Landscape: AI in Design Education

The integration of AI in education, or AIEd, is no longer a futurist speculation but a present reality. Contemporary scholarship emphasizes moving beyond AI as a simple productivity tool towards understanding it as a catalyst for pedagogical transformation. As posited by Selwyn, the focus should be on the "purposeful" and "context-aware" implementation of technology, a theme central to the model proposed here.[4] In architecture, this means aligning AI's capabilities with the core epistemic practices of the discipline: spatial reasoning, material thinking, and socio-cultural critique.[5]

The discourse has evolved from whether to integrate AI to how to do it critically. The risk of "automation bias", where the designer cedes critical judgment to the algorithm, is a key concern.[6] Conversely, the potential for AI to augment human creativity by acting as a "generative partner" is equally prominent.[7] This tension between automation and augmentation frames the need for a pedagogical structure that can navigate both possibilities.

Fast AI: Structured Workflows for Agile Fluency

The research of Longo exemplifies the "Fast-Learning" approach. The experimentation is characterized by the development of highly structured frameworks for integrating generative AI, particularly in visual communication and early design ideation.

Figure 1. Fast AI workshop visual communication and design ideation.

In the 2024 paper, Longo, elaborate a framework specifically designed to "structure and evaluate design workflow and composition of Generative AI Visualizations."[8] This framework breaks down the AI-aided design process into discrete, manageable phases-such as prompt engineering, iterative generation, and image refinement-allowing students to achieve consistent and immediate results from abstract ideas. The emphasis is on velocity and consistency within a bounded, time-constrained exercise.[9] This aligns with what Dede et al. describe as teaching for "adaptive expertise," where learners can efficiently apply knowledge in novel situations. [10]

Further developing this, Longo position these fast-cycle workshops as essential for building "intuitive fluency."[11] The pressure-free, non-graded environment of the workshop encourages risk-taking and rapid pattern recognition, training students in the "exploratory agility" needed to navigate generative AI tools effectively. The outcome is not a finished design but a cultivated skill of fast learning: the ability to quickly translate intention into AI-dialogue and visual output.



Figure 2. Fast AI workshops students' iterations.

Slow AI: Conversational Frameworks for Deep Criticality

In direct contrast, the work of Juan Carlos Dall'Asta and his collaborators champions the "Slow-Learning" paradigm, deeply rooted in the traditions of Human-Computer Interaction (HCI) and critical pedagogy.

Dall'Asta argues for an HCI approach to AIEd that views the interaction not as a command-and-response transaction, but as an iterative, reflective conversation.[12] This perspective is crucial for the slow studio. Here, AI outputs are not end products but "provisional proposals" that must be critically examined over an extended period. Students are tasked with interrogating the socio-spatial assumptions, material plausibility, and contextual coherence of what the AI generates.[13]
This slow, conversational engagement transforms the studio into a "space for deep criticality." Dall'Asta further develops this in his work on "Human-Machine Conversation (HMC)," suggesting that the goal is to use AI's speed to create scaffolding for deeper reflection.[14] The algorithm's rapid generation of multiple alternatives does not force a faster decision, but rather provides more raw material for slow, mentored critique and development. This aligns with the concept of "slow scholarship" advocated by Mountz et al., which values depth, context, and critical thought over speed and productivity.[15] The Slow AI methodology ensures that the integration of technology enhances, rather than bypasses, the development of critical spatial intelligence and embodied design judgment.



Figure 3. Slow AI module students' iterations.

A DUAL-TRACK PEDAGOGICAL MODEL

This research is grounded in a qualitative synthesis of pedagogical experiments documented in the works of Longo et al. and Dall'Asta et al. The proposed dual-track model is not a theoretical abstraction but a distillation of proven, complementary practices, strategically organised around distinct temporal frameworks and learning objectives. The methodology is conceptually underpinned by David Kolb's Experiential Learning Theory, which posits learning as a cycle of concrete experience, reflective observation, abstract conceptualization, and active experimentation. Furthermore, Donald Schön's concepts of "reflection-in-action" (thinking on one's feet during a task) and "reflection-on-action" (a retrospective critique after the task) provide a critical lens through which to differentiate the reflective practices of the Fast and Slow tracks. This model operationalizes these theories to structure the integration of AI, ensuring that technological engagement is both experientially rich and critically profound.

The Fast-Learning Track: The Experimental Workshops

The Fast-Learning track is conceived as an intensive, extracurricular workshop, deliberately isolated from the graded pressure of the core curriculum. Its primary objective is to build foundational AI literacy and technical fluency through high-velocity, experiential engagement. This approach is deeply aligned with the "concrete experience" and "active experimentation" phases of Kolb's cycle. The workshop is designed as a crucible for rapid, hands-on interaction with generative AI tools, where the speed of iteration itself becomes the central pedagogical mechanism.



Figure 4. Fast AI students' iterations.

As demonstrated in the structured frameworks of Longo et al., this environment is not about producing a resolved architectural project, but about cultivating what Schön would call "reflection-in-action" within a compressed timeframe, the ability to instantly assess an AI's output and adjust one's prompt or strategy accordingly.

The pedagogical structure is meticulously scaffolded to maximise exploratory agility. It begins with Prompt Deconstruction, where students learn to reverse-engineer successful prompts, moving from abstract intention to specific algorithmic language. This is followed by Rapid Iteration Cycles, structured sessions built on the "*prompt → output → analysis → refined prompt*" loop. Here, students engage in dozens of micro-cycles, developing an intuitive feel for the AI's logic and capabilities. To channel this experimentation, Constraint-Based Challenges are introduced, for example designing using only specified materials (light) which foster creativity within defined boundaries and prevent creative paralysis. Finally, Pattern Recognition Training involves guided group analysis of AI outputs, helping students understand the tool's inherent stylistic and formal tendencies, biases, and limitations. The environment is low-stakes and non-graded, explicitly encouraging intellectual risk-taking and "play." The ultimate outcome of this Fast-Learning track is the cultivation of a specific skill set: the ability to quickly translate design intention into a productive algorithmic dialogue, building the confidence and technical fluency that serves as a crucial prerequisite for the more critical engagements of the studio.

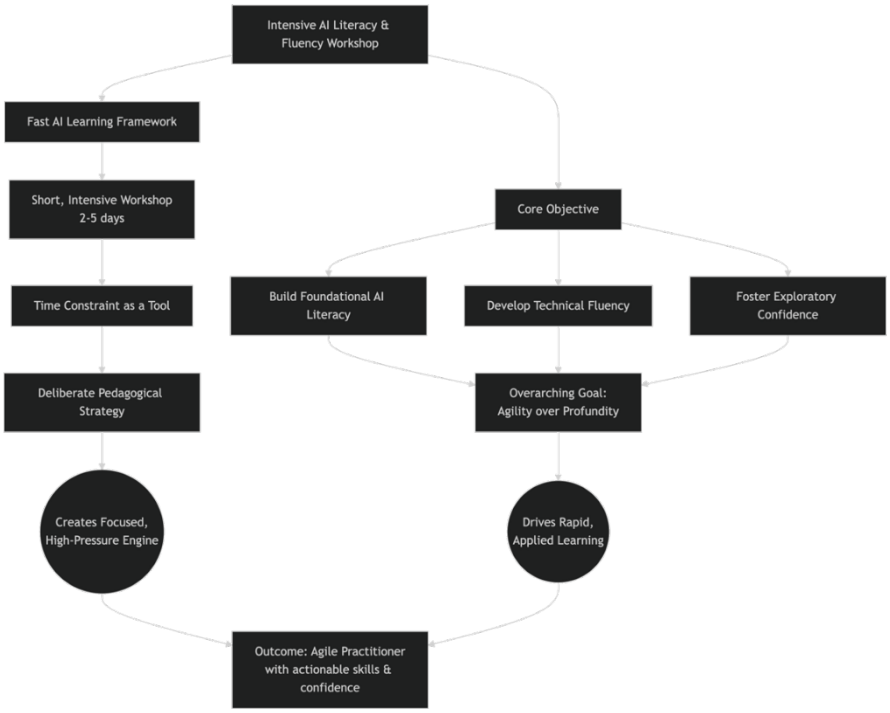


Figure 5. Fast AI learning framework.

Temporal Framework: Short, intensive format (3-5 day workshops). The constraint of time is a deliberate pedagogical tool.
Objective: To build foundational AI literacy, technical fluency, and exploratory confidence. The goal is agility, not profundity.
Pedagogical Structure: Following Longo et al., the workshops employs a highly structured, step-by-step framework.[16]
Prompt Deconstruction: Students learn to analyze and reverse-engineer successful prompts.
Rapid Iteration Cycles: Structured sessions of "prompt , output ,analysis ,refined prompt."
Constraint-Based Challenges: Exercises that limit variables ("design using only three materials") to foster creativity within bounds.
Pattern Recognition Training: Guided analysis of AI outputs to understand its stylistic and formal tendencies.
Environment: Low-stakes, non-graded (or pass/fail), encouraging intellectual risk-taking and "play." The focus is on process over product.

The Slow-Learning Track: The Critical Studio Modules

In direct contrast, the Slow-Learning track is embedded within the longitudinal framework of the core design studio, spanning a full semester or a significant module. Its objective transcends technical fluency, aiming to cultivate critical AI literacy, contextual intelligence, and reflective design praxis. This track engages with the "reflective observation" and "abstract conceptualisation" phases of Kolb's cycle, and is fundamentally a practice of what Schön termed "reflection-on-action." It reframes the studio from a place of mere production to a "conversational space for deep criticality," as theorised by Dall'Asta and Cheung, where AI interaction is deliberately decelerated to allow for sustained critical interrogation.

The methodological structure of the Slow-Learning studio is organised as an extended, iterative conversation between the student, the AI, the tutor, and the architectural context. The process begins with Seeding with AI, where students investigate a wide spectrum of initial concepts and spatial configurations in an “Understanding” process. This provides a rich, if raw, palette of ideas to work with. The core of the studio is the phase of Critical Interrogation.



Figure 6. Slow AI – understanding the AI - tools student process.

Through traditional studio rituals like pin-ups, desk crits, and written reflections, students and mentors collectively dissect the AI-generated proposals. This is where the "slow" philosophy manifests: students are guided to question the socio-spatial assumptions, material plausibility, structural logic, and cultural biases embedded within the AI's output. A visually compelling image is no longer sufficient; it must be translated into a defensible architectural proposition. This critical analysis fuels an Iterative Dialogue, a cyclical process of "*AI generation → human critique → AI re-generation*." Students return to the AI tools with new, more sophisticated, and critically-informed prompts, using the technology not for mere ideation but for probing and developing specific architectural questions. The final phase is Synthesis and Translation, where the most promising ideas, having been thoroughly tested and refined through this conversational loop, are synthesised into a final design proposal.

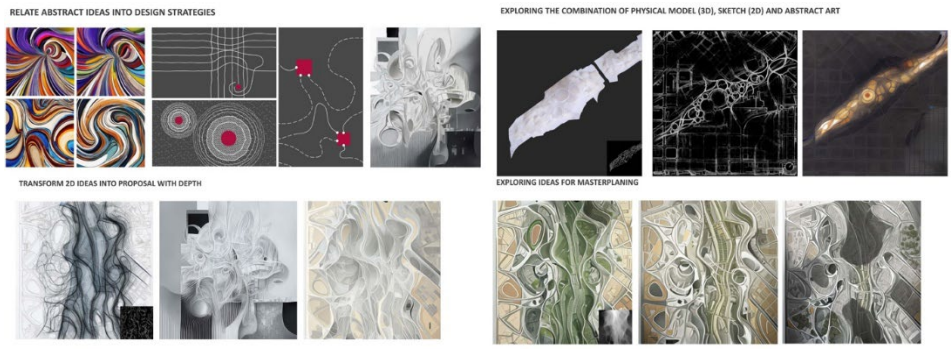


Figure 7. slow AI – AI controlled variations - student process.

Crucially, this synthesis often involves translating the digital AI outputs into more traditional architectural representations, detailed drawings, physical models, structural diagrams,to ground the speculative digital imagery in the tangible realities of space, material, and construction.
The Slow-Learning track thus ensures that AI's speed is harnessed as scaffolding for deep reflection, ultimately reaffirming the role of the human designer as the critical author and decision-maker.

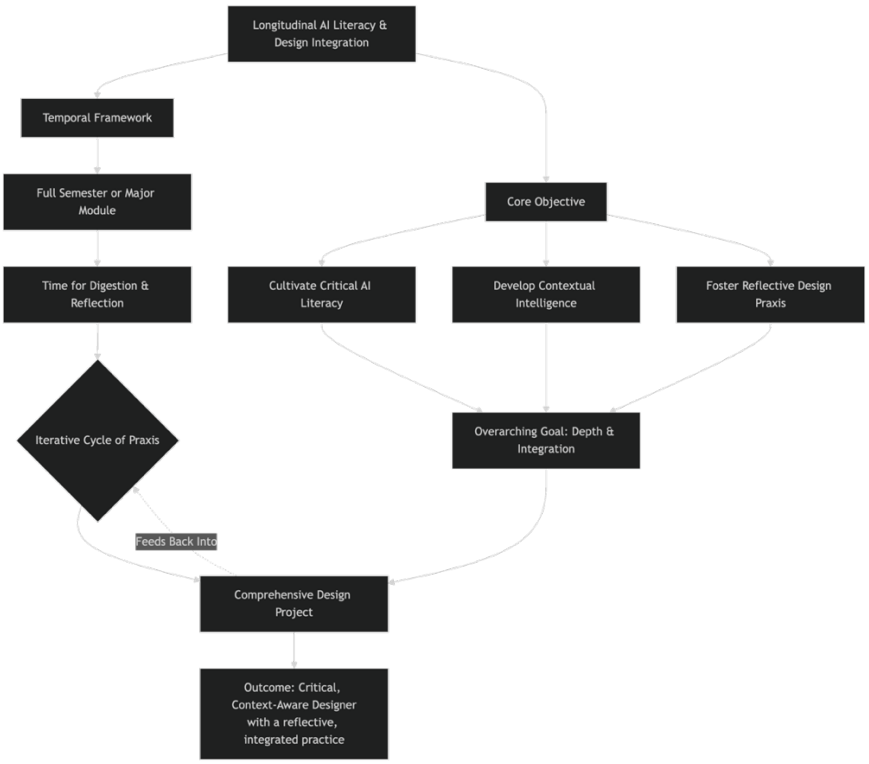


Figure 8. Slow AI learning framework.

Temporal Framework: Longitudinal, spanning a full semester or a significant module within it. Time is allocated for digestion and reflection.
Objective: To cultivate critical AI literacy, contextual intelligence, and reflective design praxis. The goal is depth, integrated into a comprehensive design project.
Pedagogical Structure: Informed by Dall'Asta's HCI/HMC approach, the studio is organized as a conversational loop.[17]
Seeding with AI: Students use Fast-Learning skills to generate a wide array of initial concepts or spatial configurations.
Critical Interrogation: Through pin-ups, desk crits, and written reflections, students and tutors collectively critique the AI proposals. Key questions include: "What biases are embedded in this output?" "Is this spatially coherent?" "How would this materialize?"
Iterative Dialogue: Students return to the AI with refined, more critical prompts based on studio feedback, creating a cyclical process of "AI generation , human critique ,AI re-generation."
Synthesis and Translation: The final design outcome is a synthesis of AI-generated ideas and deep, human-driven critical development, often translated into more traditional architectural representations (drawings, physical models) to ground the digital in the physical.
Environment: High-engagement, mentored, and graded on the depth of critical inquiry and the coherence of the final synthesized proposal.

DISCUSSION

The power of the dual-track model lies in the symbiotic relationship between the Fast and Slow modalities. They are designed to address different cognitive and skill-based facets of design intelligence, which, when combined, create a more holistic and resilient designer.

What Fast-Learning Cultivates: The Virtues of Velocity

The Fast-Learning workshop, serves several critical functions:

Demystification and Fluency: By compressing the learning curve, workshops quickly equip students with the operational skills to "talk to" AI systems, removing technological intimidation.[18]

Exploratory Agility: The pressure-free environment fosters a culture of experimentation. Students learn to "think through prompting," using the AI as a partner in brainstorming, discovering formal possibilities they might not have conceived of independently.[19] This is not about outsourcing creativity but about expanding the palette of inspiration.

Tolerance for Failure: In a fast cycle, "failed" outputs are low-cost data points. Students learn to analyze why an output failed and refine their approach, building resilience and iterative problem-solving skills that are invaluable in all design processes.

However, this mode, if deployed in isolation, carries the risk of fostering a superficial, "iconic" understanding of architecture, where the compelling image supersedes spatial, material, and social logic.

What Slow-Learning Preserves and Enhances: The Depth of Deliberation

The Slow-Learning studio directly counteracts the potential pitfalls of the fast mode by instilling a culture of critical reflection.

From Image to Architecture: Dall'Asta's conversational framework forces a translation from AI-generated images to architectural propositions. A visually striking AI render may collapse under scrutiny of its circulation, structure, or environmental performance. The slow process ensures that design decisions are justified by architectural reasoning, not algorithmic serendipity.[20]

Critical Literacy Over Technical Literacy: While the workshop teaches how to use AI, the studio teaches how to question it. Students engage in what Couldry & Mejias term "data critique," examining the socio-political and cultural data sets on which AI models are trained, and understanding how these biases can shape design outcomes.[21]

Reaffirming Designerly Judgment: The ultimate goal of the slow studio is to reaffirm the role of the human designer as the critical author and decision-maker. The AI is a tool in the service of human intention, which is developed and refined through slow, embodied, and contextual thinking.[22]

Synergy in Practice: The Virtuous Cycle

The true power of this model isn’t in the individual tracks, but in their synergy. It creates a virtuous cycle of learning. The Fast workshop equips students with the technical “vocabulary” they need. They enter the Slow studio not as novices, so the critique can immediately focus on architectural substance rather than software mechanics. Conversely, the critical thinking honed in the studio doesn’t just stay there. A student who has spent a semester questioning AI’s material and spatial assumptions will return to the next fast-paced workshop with a more discerning eye. Their prompts will be more intelligent and architecturally grounded. This cycle continuously elevates both their agility and their criticality, producing a designer who is not just fast, nor just slow, but adaptively and intelligently both.



Figure 9. The Virtuous cycle diagram.

Limitations and Future Directions

The model presents two principal limitations. First, the qualitative assessment of 'critical AI literacy' constitutes a significant challenge, moving beyond traditional metrics. Second, managing the cognitive load between fast and slow learning cycles requires careful operational design.

Future work necessitates a longitudinal study of the model's implementation across a full curriculum. Subsequent investigation should examine its long-term impact on professional design capabilities and tutor readiness.

Key questions remain:

• How does this model influence design decision-making five years later?

• How can tutors best be prepared to mentor within this dual-mode environment?

This research opens the door to a new wave of pedagogical innovation focused on the tempo of learning itself.

CONCLUSION

The technological revolution in architecture is, in essence, a pedagogical challenge. This paper has argued that a sophisticated response to AI integration requires a deliberate orchestration of pedagogical time. The binary choice between embracing AI's speed and defending traditional slow practices is a false one. The future lies in a hybrid model that strategically differentiates between Fast-Learning and Slow-Learning environments.

The research of Longo et al. provides a robust methodology for the Fast-Learning track: time-constrained, structured workshops that build technical fluency, exploratory agility, and intuitive comfort with generative AI. Simultaneously, the work of Dall'Asta et al. offers a critical framework for the Slow-Learning track: the semester-long studio as a conversational space where AI's speed is harnessed to fuel deep criticality, contextual reasoning, and reflective design praxis.

By designating the workshop for temporal freedom and the studio for temporal depth, this pedagogical model does not simply add AI to the curriculum. It fundamentally reconceptualizes design education to cultivate a new kind of design intelligence: one that is both agile and profound, capable of leveraging the immense power of AI while retaining and even enhancing the core critical, material, and embodied values of the architectural discipline. The fast and the slow are not in opposition; they are the complementary rhythms of a mature and adaptive architectural education for the 21st century.

Future work will involve the formal implementation and longitudinal study of this dual-track model within a live curriculum. Key research questions remain: How can student progress in "critical AI literacy" be effectively assessed across both tracks? How do the cognitive loads differ, and how can they be optimally balanced within a semester? Exploring these questions will be essential for refining this pedagogical framework and ensuring its effectiveness in cultivating the architects of tomorrow.

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REIMAGINING STUDIO PEDAGOGY IN THE AGE OF AI

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INTRODUCTION

The architectural design studio is the cornerstone of architectural education, nurturing creativity, critical thinking, and spatial understanding through iterative design and critique.[1] Today, the recent emergence and rapid development of Artificial Intelligence AI technologies introduce new opportunities as well as critical challenges for this long-standing pedagogy. Architectural education faces the urgent question of how design studios can integrate AI paradigms meaningfully and responsibly while preserving what makes the architectural design human-centered.

This study employs a qualitative methodology that begins with scenario analysis to map out potential future trajectories. The preferred future is then articulated, bringing together established design education pedagogies, contemporary AI approaches, and emerging future paradigms. Following synthesis and reflective alignment of the ideal future with educational realities, the study proposes an adaptive, conceptual AI-augmented human-centered framework to guide our transition through the near future marked by rapid change and uncertainty.

Background and context

The architectural design studio is deeply rooted in theories such as Schon's reflective practitioner,[2] Kolb's experiential learning,[3] and situated learning. Its pedagogy emphasizes learning-by-doing, material engagement, reflection, dialogue, and iterative feedback. It develops valuable human skills and competencies, including design judgment, embodied spatial understanding, tacit and experiential knowledge, interpretive and critical thinking, as well as agency, ethical, and social responsibility.[4]

Digital and technological advances tend to outpace curricular reform, resulting in a "readiness gap" that leaves educational institutions struggling to meet the demands of professional practice.[5] Such disruptions are not historically new. Decades ago, Banham observed that architects who resisted the emerging technologies of the early twentieth century were eventually left behind.[6] More recently, the CAD/BIM revolution has revealed a tendency for professional practice to adopt new technologies faster than educational institutions, driven primarily by market-oriented efficiency and economic productivity rather than reflective design processes.[7]

Evidently, technological transitions not only change representational methods but also reshape the epistemology of architectural knowledge. For example, the shift from manual to digital production redefined drawings as data. Now, AI challenges educators to reconsider what constitutes design cognition itself (i.e., how can we cultivate creative agency and critical literacy in an age when AI can/will simulate both?).

Generative, predictive, performance-based, and data-driven digital systems are now commonplace in leading architectural practices worldwide and are increasingly utilized in architectural education.

Advanced design platforms combining parametric modeling, AI generation, simulation engines, and immersive visualization enable rapid conceptual exploration, optimization, and iterative testing. In parallel, large language models (e.g., ChatGPT) are being incorporated into studio critique, research support, and writing processes, while AI-assisted robotic fabrication systems connect digital design with prototyping.[8] As a result, AI is gradually gaining a presence in both the design studio and the broader architectural education.

However, while AI offers great opportunities, it also raises some concerns. Scholars warn that over-reliance on AI could homogenize outputs, weaken spatial intuition, and detach students from tactile design.[9] Kvan argues that virtual design studios present valuable opportunities for global collaboration and expanded learning resources. However, they also introduce significant pedagogical challenges, including reduced tacit knowledge transfer, communication limitations, and the dilution of close student-tutor interactions.[10] Recent studies continue to echo similar concerns: for instance, Fleischmann argues that online peer critique partially preserves implicit learning yet lacks the depth of experiential learning.[11] Vaccaro et al. emphasize that the superior performance of human-AI co-creation is only achievable when humans possess robust foundational skills.[12] Additionally, Luckin et al. underline a double jeopardy risk; without deliberate critical thinking, AI adoption may not yield the desired results.[13]

Institutionally, several recent reports have called for adapting architectural education to rapid digital and technological transformations.[14] However, most educational frameworks still lack explicit references to required AI-related competencies, leaving programs to interpret this overwhelming transition independently. Moreover, this raises concerns about unequal access to advanced AI tools across institutions, which may further widen educational disparities. [15]

This seemingly unavoidable tension between fast-paced AI innovations and our rate of academic adaptability highlights the urgency for a proactive pedagogical response. A response that extends beyond simple tool-specific competencies to critical AI literacy, adaptive thinking, and resilience.

METHODOLOGY AND APPROACH

This research employs a qualitative conceptual approach that combines scenario analysis, reflective theoretical synthesis, and framework development. The study follows the structure below (Figure 1):

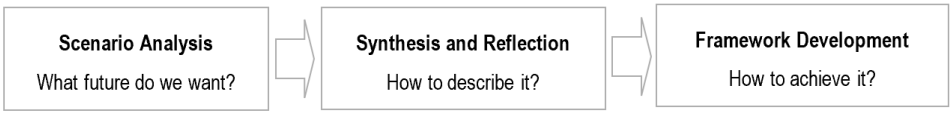


Figure 1. Methodology outline (Author)

Through the following sequential and reflective steps, the study proposes a coherent strategic roadmap for integrating AI into architectural education while preserving its human-centered character.

1. Scenario analysis:[16] A strategic foresight tool used to explore how architectural education could transform in the future. Here, rather than *simply predicting possible futures, we deliberately select our preferred one*.

2. Theoretical reflective synthesis: This stage frames the preferred future by combining insights from core design education pedagogies, together with contemporary and speculative future AI paradigms. The synthesized principles are then critically assessed against current studio contexts. This reflective check highlights mismatches between ideals and reality.

3. Framework development: Finally, principles derived from the previous stages are consolidated into a conceptual framework for AI-augmented studio pedagogy. The framework translates future aspirations into a coherent and actionable institutional strategy.
4.

SPECULATIVE FUTURES

Focusing on the near future as a transitional phase, the way we choose to engage with AI technologies in our design studios can shape multiple future pathways. Table 1 summarizes the results of a scenario analysis built upon four analytical dimensions: studio dynamics, learning outcomes, driving forces, and institutional implications. It should be noted that a scenario of total AI rejection is purposefully omitted, as historical and current lessons show that such resistance is futile.

Scenario	**Optimistic** *AI + Human = One*	**Preferred** *Hybrid = Human-in-the-Loop*	**Pessimistic** *AI = Pedagogical Substitute*
Studio dynamics	Human-AI collaboration. Students use AI tools as creative partners while educators guide reflection and interpretation.	Alternation between AI exploration and hands-on making. Educators foster ethical/critical awareness.	Algorithms dictate form and critique, weakening dialogue and reflection. Tacit knowledge and creativity erode.
Learning outcomes	Fully integrated capability in creativity, data, and collaboration. AI accelerates iterations.	Students develop dual fluency, become critical AI users, and remain skilled in material and spatial craftsmanship.	Homogenized production increases, but creativity, spatial awareness, and authorship decline.
Driving forces	Open-source tools and global networks expand access to AI. Ethics and digital literacy are embedded in curricula.	Gradual, ethical adoption via policies, training, and collaboration. Balance between computation and craftsmanship.	Unregulated, efficiency-driven automation replaces human judgment and skill.
Institutional implications	Investment in AI labs, faculty upskilling, and ethical oversight.	Adaptive curricula, continuous faculty training, and equitable access ensure AI supports creativity.	Faculty lack AI literacy. Inequality widens between institutions. Policies/standards lag behind AI advances.

Table 1. Contrasting future scenarios of AI integration in architectural design studios

Interestingly, popular cinema has visualized both the pessimistic loss of control in *I, Robot* (2004), *Ex Machina* (2014), and *The Matrix* (1999), as well as an optimistic bio-digital fusion between humans and intelligent systems in *Ghost in the Shell* (2017) and *Her* (2013). Other films, such as *Lucy* (2014) and *Transcendence* (2014), imagine a post-human existence where consciousness completely detaches from the biological body. Our preferred hybrid scenario aligns best with ideas in *Iron Man* (2008) and *Robocop* (1987), where technology amplifies rather than replaces human judgment and creativity.
From the previous analysis and analogy, it becomes clear that the *central question is not whether AI will surpass humans, but how we choose to coexist with it*, whether as a substitute, collaborator, or co-creator. In this light, architectural education must proactively and judiciously script its own scenario of future coexistence.

THEORETICAL GROUNDING AND REFLECTION

Following the identification of the preferred hybrid future, we need to outline how it should be shaped. This will logically build upon the time-tested pedagogies in design education and AI's expected epistemological shifts. Bringing these two together requires reflection, synthesis, and alignment to consider the realities of the academic world before being used as the foundation for the framework, as explained in Figure 2.

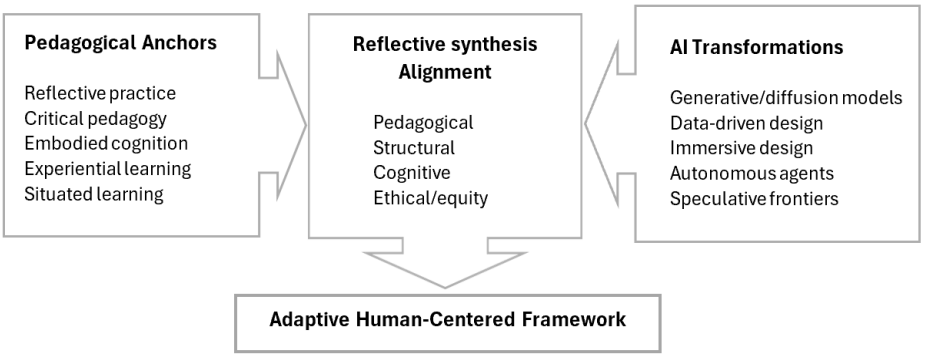


Figure 2. Framework's theoretical grounding and alignment (Author)

Foundational pedagogical anchors

To derive and define the core human-centered competencies of design education that must be preserved, and through which AI integration can strengthen rather than erode the humanistic core, five foundational pedagogical anchors are stressed, namely:

1. Reflective practice:[17] Design knowledge develops through reflection-in-action by framing and reframing problems through iterative explorations.
2. Critical pedagogy:[18] The black-box nature of AI algorithms necessitates a critical understanding. Students must be taught to question generated data/results, uncover biases, and understand what lies behind AI models (AI literacy).
3. Embodied cognition and phenomenology:[19] Spatial intuition, material awareness, and sensory judgment are inherently human and physical. Embodied learning is needed to counterbalance digital abstraction.
4. Active and experiential learning:[20] Design knowledge develops through learning-by-doing, reflection, and synthesis.
5. Situated learning and communities of practice:[21] Students learn design more effectively when they work and grow within shared learning communities.

AI transformations in design education

AI is already changing our studios into a hybrid learning model that merges computation, immersion, and reflection. Below are some AI systems that are currently transforming design workflows, with the understanding that future technologies may radically reshape them further:

• Generative design, diffusion models, and large language models LLMs: Tools such as Midjourney, DALL·E, Stable Diffusion, and ChatGPT shift the designer's role from drafting to editing and interpreting. They require new literacies in prompt design, constraint definition, and semantic control. These are skills essential for directing rather than following generative design.

• Data-driven design, predictive analytics, and digital twins: AI-enhanced simulation enables dynamic models with real-time design decisions. These tools require architects to possess the necessary knowledge to judge and evaluate outputs.

• Immersive design and XR environments: Virtual, augmented, and mixed reality (VR/AR/MR), and spatial computing platforms allow students to design and manipulate full-scale digital environments, supporting experiential testing, collaboration, and design evaluation.
• Autonomous agents and emerging frontiers: AI co-pilots, generative fabrication, and research in quantum and bio-computational design are paving the road for future self-optimizing systems.
Any pedagogical framework must consider how AI changes the way students learn, think, and produce design knowledge, including its technological, cognitive, ethical, and spatial dimensions:
• Technologically: Address the range of AI tools, from generative to fully immersive platforms, and how they can accelerate iterative workflows, support collaborative production, and influence creative authorship and evaluation.
• Cognitively: Consider how students learn, think, and apply knowledge in environments shaped/augmented by AI. Leverage AI's rapid iteration capabilities to free time for deeper critical reflection and design reasoning.
• Ethically: Raise questions of agency, bias, and transparency to ensure that AI is integrated in a responsible and accountable way.
• Spatially: Maintain and capitalize on the potential for enhanced spatial awareness through both physical and virtual environments.
Together, the above AI-related dimensions define the foundation for an adaptive, human-centered framework that can evolve with AI while preserving the core values and educational depth of the design studio.

Reflective synthesis and alignment: Paradigms vs realities

The preceding trajectories have pointed us toward our ideal desired future; however, their translation into everyday academic settings is not that easy. Some alignment (reality check) should address pedagogical, structural, cognitive, and ethical/equity issues.
• Pedagogical alignment: While many schools still prefer to operate within predominantly pre-digital settings, AI is gradually finding its way into mainstream architectural pedagogy through experimental teaching practices. These initiatives reconfigure core studio learning processes by positioning AI as a driver of pedagogical change. For instance, Kachaamy uses Zero Gravity (conceptual AI-assisted design software) to explore visionary airborne architecture.[22] Similarly, Özorhon demonstrates how AI image generators, powered by diffusion algorithms, become integrated into studio cycles of reflection, critique, and iterative human–AI dialogues.[23]
• Structural alignment: Many institutions may struggle to transition into an AI-future due to limited infrastructure, fragmented/nonexistent digital policies, and uneven faculty readiness.[24] Addressing these challenges requires coordinated institutional action, with evidence showing that targeted, institutionally supported faculty development can effectively transform traditional teaching into hybrid learning models.[25]
• Cognitive alignment: AI-augmented studios call for new ways of thinking, reflection, collaboration, authorship, and collective intelligence across physical and virtual domains. For educators, this challenging role shift may require moving from expert authorities to facilitators and supporters of learning processes.
• Cultural and contextual alignment: Educators should make sure that globally trained AI models in AI-augmented studios remain sensitive to cultural, climatic, and socio-spatial contexts.
• Curricular and assessment alignment: Studio projects in AI-augmented environments should value the process rather than the output. In this transitional period, design briefs should include both analog and AI-assisted tasks, requiring students to justify their design choices and critique AI-generated

alternatives. Likewise, assessment methods must prioritize reasoning, authorship, and reflective practices.

• Ethical/equity alignment: Using AI in design education fairly and responsibly requires more than just technical skill. It needs awareness of issues such as access, bias, and accountability.

Recognizing these tensions highlights the need for an adaptive framework that *does not import AI tools into existing pedagogies but reimagines new studio paradigms*. The subsequent conceptual framework tries to structure this alignment, reconciling theoretical ideals with institutional realities to guide a much-needed gradual transition.

CONCEPTUAL FRAMEWORK

To translate theory into action, a conceptual framework is proposed. The framework uses the structural strategic planning model VMOSA (Vision, Mission, Objectives, Strategies, and Action Plans). This model is widely used in educational reform and institutional planning. Its clear sequential structure aligns well with institutional processes and matches the strategic language of international accrediting bodies. While this model provides the foundational backbone, other planning models/techniques can be used later to refine objectives, develop curricula, and structure learning processes (e.g., SMART for refining objectives). Figure 3 below outlines the steps of the proposed framework.



Figure 3. Proposed framework outline (Author)

Vision (desired future)

The framework envisions a human-AI studio synergy that amplifies creativity and judgment while preserving ethical, spatial, reflective, and embodied competencies.

Mission (purpose)

Translate pedagogical principles into adaptive methods that integrate AI as a constructive partner in design education, enabling a gradual and resilient transition.

Objectives (core competencies)

The objectives outline the framework's foundational competencies that ensure AI integration remains human-centered and grounded. Figure 4 outlines the focus and pedagogical goals of each pillar.

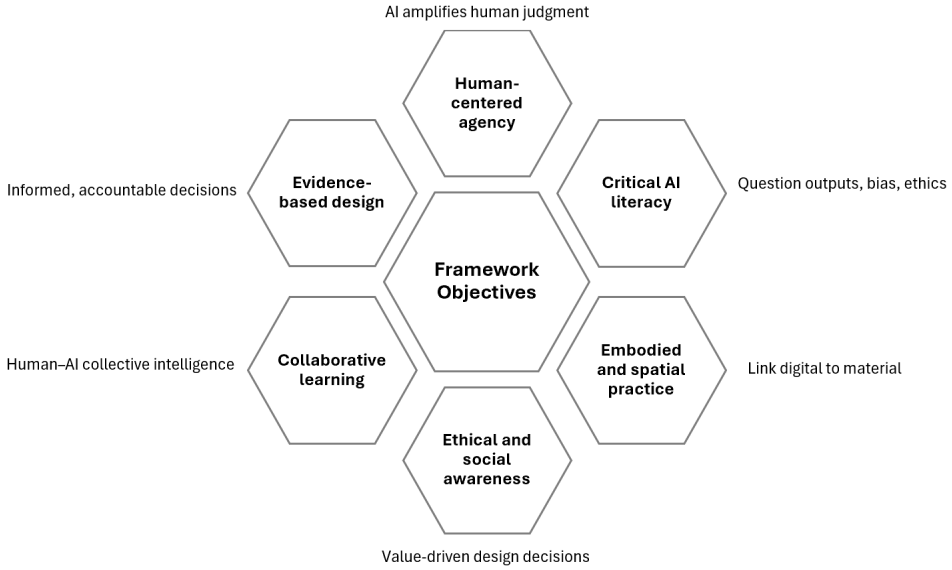


Figure 4. Framework objectives (Author)

Strategies (approaches)

Having defined our key objectives, five key strategies are proposed as the primary pathways for implementation; additional or context-specific measures may be developed/adopted as needed. Table 2 details the educational goals and implementation focus of each strategy.

Strategy	Goals in the AI-augmented studio	Implementation focus
Dual fluency development	Equip students with skills in both hands-on and AI-augmented workflows.	Alternate between the two learning modes.
Prompt design as conceptualization	Reframe prompt engineering as a critical act of design thinking.	Use prompt design as tasks in studio briefs.
Hybrid critique and assessment	Evaluate the human-AI dialogue (process), not just the final output.	Use XR environments and design journals to track iterative decisions.
Data-informed design judgment	Teach students to interpret and evaluate AI-enhanced simulations and analytics.	Focus on critical judgment over passive generation.
Faculty and institutional readiness	Build faculty AI skills, ethics, and teaching methods. Align the institution's policies and assessment.	Provide faculty training, institutional AI policies, and adaptive assessment methods.

Table 2. Framework strategies.

Action Plan (execution)

The following action plan translates the above strategies into a practical roadmap. It outlines how implementation progresses across phases, who is responsible, and what institutional enablers, evaluation methods, and feedback loops sustain and refine the process.

a. Implementation phases

Figure 5 illustrates implementation phases for integrating AI into architectural education, progressing from foundational awareness and experimental adoption to institutional consolidation and continuous evolution.

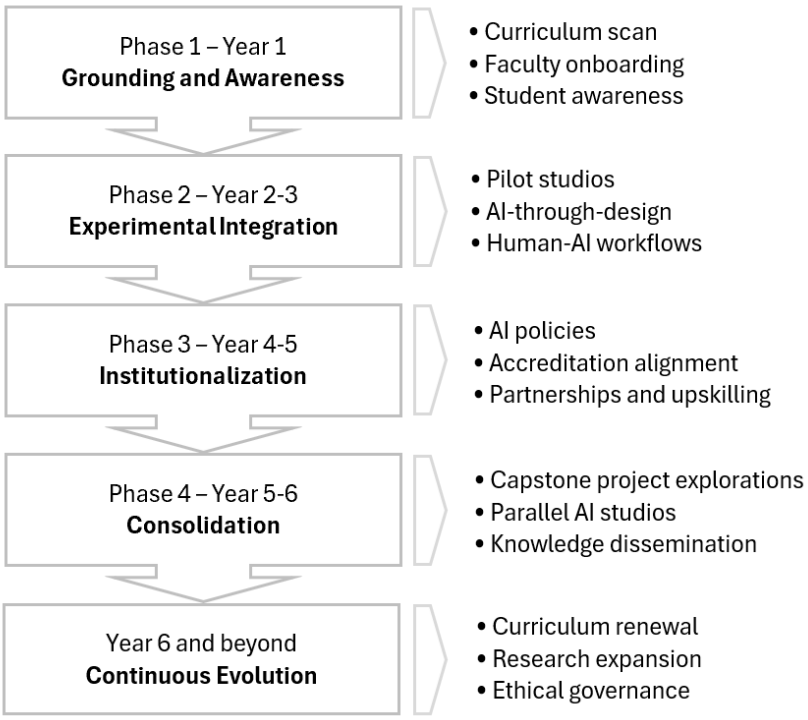


Figure 5. Implementation phases (Author)

b. Identifying stakeholders

The successful implementation of the framework depends on the coordinated participation of multiple stakeholders. The following part identifies the main stakeholders and their roles and responsibilities within the framework:

- Students: Active co-creators shaping ethical AI use.
- Faculty: Mentors translating reflective pedagogy into hybrid workflows.
- Administrators: Providers of vision, funding, and policy alignment.
- AI developers and industry partners: Collaborators creating transparent, education-oriented tools.
- Ethicists and social scientists: Custodians of critical inquiry and social equity.
- Accrediting bodies: Gatekeepers updating standards to include AI literacy and ethics.

c. Institutional enablers

To support these stakeholder roles, several interdependent, hierarchically structured institutional enablers are required to provide the necessary resources, capacity, and policies for effective implementation (Figure 6).

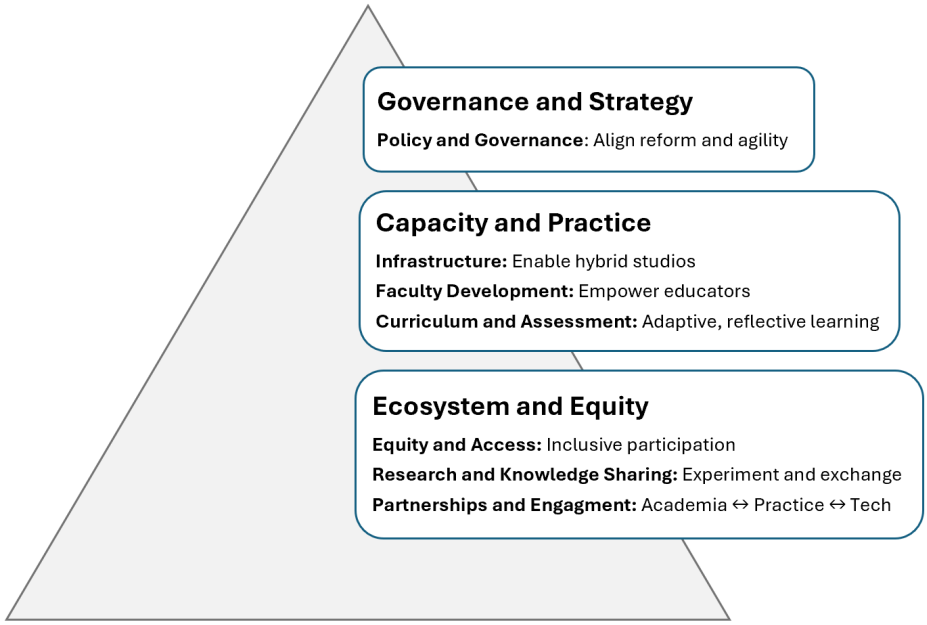


Figure 6. Hierarchical institutional enablers and their roles (Author)

d. Evaluation and continuous feedback

Embedded evaluation is integral to the framework, operating across all levels rather than as a final step. A proposed assessment rubric should focus on:

1. Architectural merit: Quality and innovation of the design outcome. Demonstrating creative and critical integration of AI-generated insights with human judgment.
2. Co-creative and adaptive workflow: Clear documentation of AI–human collaboration and authorship, showing reflective iteration, adaptability, and shared intelligence.
3. Ethical AI literacy: Understanding of data generation, algorithmic bias, and tool ethics. Documented capacity to justify choices and maintain transparency in AI-assisted processes.

Regular feedback loops, via student reflections, peer review, and faculty surveys, will ensure the framework remains adaptive and ethically accountable.

EXPECTED OUTCOMES AND FUTURE VALIDATION

While empirical validation for the framework is planned for the next academic cycle, we could speculate on the following qualities to emerge in students' outcomes:

• Design outputs that explicitly reflect the process of human–AI collaboration, not just final forms.
• Traceable workflows, including prompt development, iterative testing, and critical selection of AI-generated alternatives.
• Documented decision-making and evolution of ideas through the use of annotated drawings, process diagrams, or design logs.
• Clear evidence of the interplay between intuition and computation, demonstrating both creative agency and analytical judgment.
• Progressive development across implementation phases:

a. Early stages: experimentation and tool engagement
b. Advanced stages: coherent integration of concept, ethics, and design reasoning

LIMITATIONS AND ASSUMPTIONS

The proposed framework is a conceptual foundation intended to inform and be further validated through future studio-based and longitudinal research. It assumes institutional willingness and full faculty engagement with hybrid pedagogies as enabling conditions. Given the accelerating development of AI and the likelihood that some AI platforms may become obsolete in the future, the proposed framework aims, as much as possible, not to prescribe specific AI tools/technology. This is intentional to remain adaptable, resilient, and focused on principles rather than applications.

CONCLUSIONS

AI is here to stay, and nobody knows what it will become in ten or fifteen years. While the future of architectural education in an AI-augmented world remains uncertain, *perhaps the best we can do is to remain human in intent, yet adaptive and resilient in our methods.* The proposed framework tries to cultivate the best of both worlds by combining our enduring human competencies, which define design thinking, with the ever-expanding capabilities of AI.

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VIRTUAL REALITY AS A GAMIFICATION STRATEGY IN ARCHITECTURAL EDUCATION

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INTRODUCTION

Virtual reality is a technology geared toward spatial immersion: the operator is introduced into a virtual environment in which they can move, interact, and explore various multimedia content—images, videos, or sounds—through movements, sound, buttons, and specific gestures.

The virtual experience is considered immersive because the subject is isolated from their context and immersed in a simulated view of space[1] through the use of electronic devices: lenses and gloves[2] that allow them to interact with digital forms and elements projected in the simulation, creating the sensation of being in the place, even though it does not physically exist.

Technological evolution has made the virtual experience increasingly focused and specialized, as sensory elements that are activated through sight, touch, and even smell have been progressively incorporated, as reported in the explorations of Li et al.[3] and the work of Pei et al.[4] With this sensory experience, beyond the visual, the person is fully immersed in the simulation and experiences virtuality in a more comprehensive way.

If architecture deals with the design and habitability of spaces,[5] virtual reality prioritizes the principle of moving around and exploring a place that does not exist, as it is a simulated space. This is where its greatest contribution and promising future for design lie, as new virtual spaces need to be explored and designed from the professional perspective of architecture.

The beginnings of this technology are linked to recreational activities, as the first experiments arose in the context of video games.[6] However, virtual reality is now used in the professional field and, specifically, in design on various scales: urban, architectural, industrial, and interior design.

Gamification and architecture

On the other hand, gamification is a pedagogical strategy applied in the classroom for learning through play; it seeks to generate, through techniques that are fun for students, new learning experiences that are more meaningful and valuable for their growth process.[7]

Together with virtual reality, it is applied in various areas of design education,[8] from basic to university levels, adapting to the training cycle and educational models.[9] As a result, it has been gaining ground in the pedagogical discussion of new generations.

Currently, many gamification strategies are associated with the use of information and communication technologies, as electronic devices are a familiar medium for students at school age, who arrive with new and challenging expectations for learning; therefore, the aim is to motivate the curiosity and creativity of the participants.

Such is the case with architecture, whose primary pedagogical function is to emphasize creative thinking as a strategy for design training. As a professional practice, it requires skills and abilities that encompass spatial perception, architectural drawing, and learning digital design tools, among others.
Gamification in the architecture classroom is, therefore, a strategy for exploration:[10] learning by doing, designing by creating, solving creatively through playful exercises, and incorporating digital tools into the design process as a fundamental part of contemporary architecture.
A key point of gamification and virtual reality is simulation,[11] as it places the subject in scenarios that can be explored for prior professional practice, learning a process, or developing tasks necessary for the technical execution of architecture as a constructive discipline.
It should be noted that gamification has always been present in the architecture classroom, particularly about design, since the very process of learning about form and space involves the playful experience of using volumes or blocks to create solids and voids, as well as spatial cavities that emerge from the dynamics of juxtaposing pieces. While it is true that, in many cases, this is explored through three-dimensional models, such as scale models or volumes, understood as means of learning and formal representation of architecture, these are preceded, precisely, using play as a form of creative expression.
Furthermore, gamification can have real implications for professional practice through role-playing, in which, using analog or digital simulators, decision-making, critical thinking, and other fundamental aspects of construction design are trained. In this sense, VR also constitutes an emerging and highly relevant field for the teaching of architecture, as the virtual object functions as a medium for training and learning, in which video game strategies, blocks, or models are combined to give rise to new forms of expression.
Thus, gamification is an open field to be explored through immersive technologies applied to architecture, not only in matters of management, practice, or resource management, but also—and especially—with an emphasis on design, creativity, and the generation of new ideas.
This work fits precisely into this line of thinking: incorporating virtual reality into the classroom for pedagogical purposes, using gamification as a teaching strategy mediated by spatial virtuality, simulation, and digital modeling. To this end, the study applies a statistical model to validate playful experiences with virtual reality in architectural learning.

METHODOLOGY

In terms of methodology, the study has the following general objective: to evaluate the experience of gamification in virtual reality among architecture students using the GAMEX instrument.
GAMEX stands for *Gameful Experience in Gamification*, an instrument that measures the learning experience applied in educational environments, mainly in English- and German-speaking contexts, and which, for this occasion, was adapted into Spanish based on the translation by Parra and Segura.[12]
The GAMEX instrument, also known as the gamified experience scale, addresses six dimensions:
Enjoyment/fun: assessment of the experience of playing.
Absorption: degree of involvement in the experience and sustained attention.
Creative thinking: activation of the imagination during the experience.
Activation: interest and energy invested in playing the game.
Absence of negative effects: presence/absence of emotions or factors that affect the playful experience.
Mastery: feeling of being in command or in control during the game.
Using a quantitative approach, the study validated the virtual reality experience of 51 students from the School of Architecture at the University of Monterrey, who were enrolled in the Architectural

Representation course in the second semester. The sampling was non-probabilistic, circumstantial, with students who took the course between 2023 and 2025. The dimensions of the GAMEX instrument were rated on a Likert scale from 1 to 5.[13] The questionnaire consists of twenty-seven items and was administered in Spanish to the entire population.

Procedure:

First: preparation of the VR sessions, with the instructional design of the exercise.
Second: VR sessions for the design using Arkio software, lasting three hours.
Third: application of the data collection instrument at the end of the session.
Fourth: analysis of results (by items and dimensions) and writing of results and conclusions.

Equipment and software:

Meta Quest 2 glasses were used, which allow immersion and manipulation of objects using hand controllers. The modeling software was Arkio, in which students were able to design, set the scene, and render their work, and review it in the cloud, from laptops or tablets.
The task consisted of designing a habitable architectural object, set with elements and objects, as an introduction to digital modeling. The session lasted three hours, after which the questionnaire was answered.

RESULTS AND DISCUSSION

The data were analyzed using descriptive statistics and organized based on the calculation of means per student, per item, and per dimension. At the same time, standard deviations were estimated and, using 95 percent confidence intervals, the dimensions were compared with each other, also applying Student's *t-tests* for paired (bilateral) samples to verify whether the differences observed were statistically significant.
For ease of reading, the results are presented progressively:
The first approach was through analysis of the means or averages weighted by dissensions: In terms of assessment level, the dimensions with the highest means were enjoyment/fun and absorption.
This indicates that students perceived the virtual reality experience positively as a playful strategy that promotes motivation and idea generation. The rest of the dimensions (creative thinking, activation, and mastery) were at an intermediate level, reflecting a favorable experience but not as high as the previous ones.
The lowest dimension was absence of negative effect, showing that not all students experienced the experience with the same degree of comfort. These data are shown in the following table, along with their classification levels.

Dimension	Media	Clasification
Enjoyment	4.575	High
Absorption	4.493	High
Creative thinking	4.077	Medium
Activation	4.029	Medium
Mastery	3.815	Medium
Absence of negative effects	2.821	Low

Table 1. Weighted averages of the dimensions of gamification.

This result is understandable because students really enjoy it when they are offered a different educational experience. In most cases, it was the first time they had worked with virtual reality and entered an immersive environment designed for learning design, not just for playing. That is why the experience had a greater impact: they did not just "use VR," but linked it to what they study, the analysis and spatial understanding of architectural objects. And that combination of novelty and academic relevance is precisely what explains why the dimensions of enjoyment and creative thinking appear so high.

To deepen the analysis, the standard deviation (SD) of each dimension was calculated in order to determine how consistent the students' responses were and whether the ratings were homogeneous or widely dispersed.

The SD graph was also organized into three levels:

First: low SD, very homogeneous responses, high consensus.

Second: Medium SD, moderate variation, clear trend.

Third: high SD, heterogeneous group, divided or polarized experiences.

Applying this criterion, we observe that the dimensions with the highest means (enjoyment and creative thinking) also have a low or moderate SD, which means that it was not just a few enthusiastic students, but rather that the positive assessment was widely shared by the participants.

In contrast, the absence of a negative effect showed the highest SD (above one), indicating that not everyone experienced the same thing, hence the point of interest in paying attention to this disparity in the results.

Dimension	SD	Clasification
Enjoyment	0.555	Homogenous
Absorption	0.504	Homogenous
Creative thinking	0.930	Homogenous
Activation	0.909	Homogenous
Mastery	0.854	Homogenous
Absence of negative effects	1.358	Heterogenous

Table 2. Standard deviation (SD) of the gamification dimensions addressed.

The 95 percent confidence interval was also calculated for each dimension. This indicator does not mean "the probability of obtaining exactly the same result," but rather shows the range within which it is reasonable to think that the true population mean lies if the same instrument is applied to similar groups. The 95 percent CI is obtained by considering the observed mean, the standard deviation, and the critical value of the *t-distribution* according to the sample size.

In practical terms for this study:

Narrow CIs (as in enjoyment and creative thinking) indicate accurate estimates and, therefore, consistent results among students.

Wider CIs (as in the absence of a negative effect) confirm what the SD already showed: there is more heterogeneity in the responses, i.e., students did not experience that dimension in the same way.

This helps to justify, in the discussion, that gamified VR works well to motivate and activate creativity, but that it needs to be refined in terms of comfort, timing, and familiarization with the equipment.

Dimension	Media	SD	CI 95% (i)	CI 95% (s)	Clasification
Enjoyment	4.575	0.555	4.419	4.732	High
Absorption	4.493	0.504	4.351	4.635	High
Creative thinking	4.077	0.919	3.819	4.336	Medium
Activation	4.029	0.930	3.768	4.291	Medium
Mastery	3.815	0.854	3.575	4.056	Medium
Absence of negative effects	2.821	1.358	2.439	3.202	Low

Table 3. Confidence interval (CI) of the gamification dimensions.

In Table 3, it is important to note the width of the CIs (whether they are wide or narrow) to identify where there is greater dispersion and, therefore, where students' perceptions were less homogeneous. Although the disparity in data between the highest and lowest dimensions was already known, a more in-depth analysis allows for the following summary:

First, enjoyment and creative thinking have high means with narrow CIs; this indicates that the virtual reality gamification experience was positive and, above all, consistent among most students.

Second, the absence of negative effects shows a low mean and a wider CI, greater variability. This means that not all students experienced the experience in the same way: some had no problems, but others reported discomfort, fatigue, difficulty with the equipment, or with the timing. This statistical behavior suggests that there are factors of the experience that need to be adjusted.

The item-by-item analysis showed that item 20, belonging to the dimension of absence of negative effect, was the one with the most disparate responses of the entire instrument, with percentages distributed across several options on the scale. This behavior helps explain the high SD of the dimension and its wider CI, and suggests that the VR experience, although valued as motivating, is still conditioned by implementation factors.

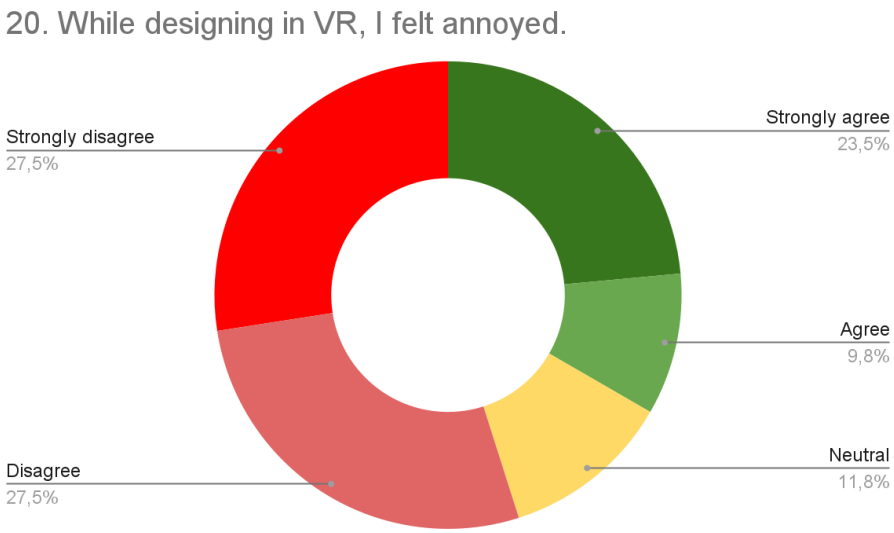


Figure 1. Item 20.

This result may be due to several factors:
The timing and schedule of the practices, which for some students were inflexible or too long for a single immersive session.
The ergonomics of the equipment, which is still heavy and can cause physical fatigue after several minutes of continuous use.
The usability of the software, as for many it was the first time they had used it for design purposes (and not just to "play" in VR), which implies a learning curve.
The complexity of the task: designing and modeling a three-dimensional architectural object with limited information and in a playful format can be challenging, especially considering the level of training of the participants (first semesters).
To verify whether the differences observed were attributable to chance, Student's *t-tests* for paired (bilateral) samples were applied, comparing the highest-rated dimensions (enjoyment, creative thinking) with the lowest-rated (absence of negative effect).

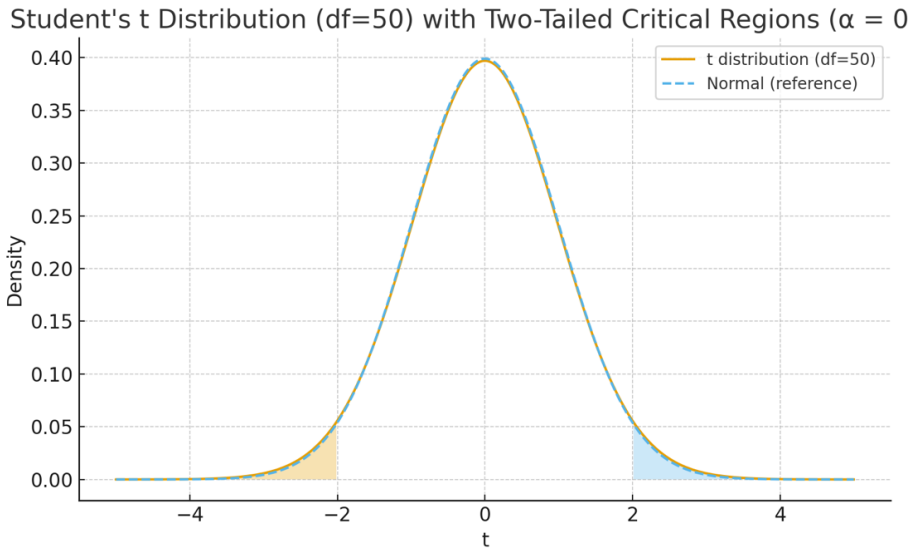


Figure 2. Student's t-distribution.

In all cases, the observed *t-values* were well above the critical value, therefore, there are statistically significant differences between the positive dimensions and the negative effects dimension. The graphical representation of the t-distribution allows us to visualize that these differences are clearly outside the non-rejection zone, reinforcing the idea that the pattern found is not random.
Overall, the results allow us to affirm that gamified VR is highly effective in activating enjoyment and creative thinking, but that it requires adjustments in instructional design, familiarization with the equipment, and session duration to reduce negative effects and thereby narrow the dispersion observed in that dimension.

CONCLUSION

The study confirms the hypothesis that virtual reality is a useful tool for gamification in architectural learning, as it motivates and engages students in understanding the solution of forms in space in an intuitive and creative way.
Virtual reality generates solutions that open up new fields of exploration for pedagogy and design practice in simulated scenarios.
Therefore, the research demonstrates the existence of a clear strength: gamified VR strongly stimulates imagination and ideation and does so consistently and relatively uniformly in students who are learning architectural design processes.
However, weaknesses associated with the experience and the tools are also identified, which are reflected in the dimension of absence of negative effect, considered the weakest point of the study, as it presents a low mean and a large dispersion. This suggests the presence of factors linked to frustration, discomfort, dizziness, or overload in some participants.
The most important implication lies in the design process: VR shows high potential for enhancing creativity, but it does not in itself guarantee comfort or the full adaptation of all students to the immersive environment.
Therefore, the quality of the experience must consider not only the use of equipment or application times, but also aspects of ergonomics, breaks, periodic familiarization sessions, and instructional design, which help to regulate the perceived negative effects.
In addition, the study confirms the statistical analysis process for validating the gamification and VR experience in the classroom, which can be replicated in other studies through the application of the GAMEX instrument.
In short, virtuality remains a frontier to be explored from the perspective of architecture, as it challenges several of the tangible foundations of materiality and spatial movement. However, these immersive experiences allow users to approach spaces that do not physically exist but can be explored, perceived, and understood, opening a field of multiple possibilities for schools, teachers, students, and architecture professionals, who operate in a context of constant technological adaptation.

NOTES

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TEACHING FROM THE POSITION OF THE SUBALTERN: REFRAMING THE HISTORY OF ARCHITECTURE SURVEY TO FOSTER CRITICALLY CONSCIOUS ARCHITECTS

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INTRODUCTION

I teach the history survey sequence at the University of Puerto Rico's School of Architecture.[1] In 2024, when I joined the faculty, official course descriptions confirmed these courses remained very much Euro-US-centric. Despite broadly observing NAAB's requirements,[2] the history curriculum could still be viewed by some as sexist, elitist, racist, and generally othering, as architectural education in Puerto Rico has not been fully decolonized.

While attending the same program four decades ago, the teaching/learning dynamics strongly encouraged the memorization of dates, architects, and locations. As students, we were supposed to recognize styles and be able to visually identify buildings from an extensive geographic and historical catalogue. As instructors typically reduced architecture into images and objects, architectural history courses were highly descriptive as opposed to analytical. In addition, the content chosen mistakenly made it seem as if relevant architecture was the sole domain of mostly white, male "geniuses." Throughout my undergraduate education in Puerto Rico, history professors completely overlooked the presence of women in architecture and, with the usual exceptions, such as that of Egyptian or Mesopotamian architecture, all buildings, styles, and cultural contexts not fitting neatly along the trunk of Fletcher's Tree of Architecture or that diverged from a Western, meaning European, genealogy or a monumental morphology, including Puerto Rico's, were discarded. To put it mildly, the history surveys offered to me as a young architecture student did not consciously integrate the notion of "difference," nor did my professors recognize the operative value of history within professional practice.

A profound critique of my early orthodox, positivist-framed education led me to eventually recognize it as part of a teaching/learning system anchored in paternalism and patriarchy which, intending to serve the interests of authority, considered students to be empty vessels that were supposed to passively take in the knowledge that teachers deposited in them.[3] In other words, as a type of banking education, as defined by Paulo Freire. This model, still practiced today by some in architecture schools, inhibits students' capacity for critical thinking, discourages curiosity, and suppresses the formulation of deep questions that may assist them in becoming "competent rebels" instead of "competent conformists."[4] "Strong questions," as Boaventura de Sousa Santos declares, "go to the root and vocation"[5] of what is being probed. Following suit, regarding the history surveys I was about

to teach, the question I initially asked was: as they are, do these bear any relevance for us, as Puerto Rican-Caribbean-Latin American-US citizens and to the design of hopeful and situated future(s)?

TEACHING/LEARNING FROM THE POSITION OF THE SUBALTERN

Unconsciously, perhaps, hegemonic learning/teaching practices maintain a logic of domination within architectural education in Puerto Rico. However, as a Puerto Rican woman, born and raised in a doubly colonized island, I acknowledge my difference as an analytical tool and as a sociopolitical stance that, as a form of resistance, informs a decolonizing approach to architectural education.

In my experience, academics in local schools of architecture seldom question, acknowledge, or explain the coloniality of knowledge present in the discipline.[6] As such, pedagogical mimicry often appears through uncritically focusing on, blindly accepting, and indiscriminately replicating universalist metanarratives and objects.[7] Arguably, architectural pedagogical mimicry overvalues and tries to emulate buildings, programs, forms, and images from the Global North as well as their (white) "Masters" toolkits.[8] Reflecting colonial mimicry, as defined by Homi Bhabha, imitation tends to guide an education where the subalternized are made to think and produce as "…reformed, recognizable Other[s], *as…subject[s] of a difference that is almost the same, but not quite*."[9] In other words, a mimetic architectural education coerces students into conforming and, perhaps, into unconsciously remining subaltern(ized) by demands to perform "*for* an Other."[10]

Can we drastically shift focus? Are we capable of questioning the claims of Western epistemological dominance? Can we refrain from validating the notion that universal ways of being-in-and-understanding the world are preferable to those that are native? Can we recognize difference/diversity, along with situatedness, as alternative resources for teaching/learning? Pluriveresality, as Walter Mignolo explains, means to adopt (I would also add, to rescue) forms of knowledge and meanings that allegedly fall outside of the scope, rules, and pedagogical traditions of Euro-US-centric though systems.[11] The idea of the pluriverse stems from the Mexican Zapatistas, who recognize a world in which multiple worlds may coexist.[12] This notion, as was later developed by decolonial thinkers, including Arturo Escobar,[13] serves as a form of critique to the universalist and homogenizing world view of the Global North. As Mignolo contends, "pluriversality becomes a decolonial way of dealing with forms of knowledge and meaning exceeding the limited regulations of [Western] epistemology and hermeneutics."[14]

Although this is slowly changing, history professors in Puerto Rico typically frame design as an ever benevolent, good-willed practice. Despite efforts to encourage an inclusive view, Euro-US-centric ways of being-in-and-understand the world are commonly prevalent in survey courses. What professors select, the ideas emphasized, and their general approach and interpretation of history reinforce the logic of domination. For instance, over the years I have observed that there is consistent negation to problematize architecture's connection with the extraction and subalternizing legacies of colonialism regardless of it being a constant thread within our own architectural history. There also seems to be an unwillingness to ponder the influence of coloniality within the architects' approach and understanding of practice; for example, the ways architecture shaped and continues to shape the world in manners that tend to maintain gendered, racialized, and other forms of hegemonic structures.

My approach to the history surveys stands on the recognition of architecture's historic stronghold with authority along with Puerto Rico's colonized status. Both issues are significant, but the latter explains, in part, why architectural education on the island has been decidedly mimetic of US programs and ways of teaching even though, historically and culturally, Puerto Rico has more in common with the Caribbean or Latin America, and experientially, with other groups within the Global South. As a measure of divergence from my own education and as a form of resistance against the complicit

nature of architecture with the construction of physical and epistemological spaces of/for domination, insurgency and (in)discipline frame my teaching. Following Argentinian theorist Marina Waisman, my situated nonconformity[15] intends to develop a teaching/learning practice that reframes Puerto Rico's position and narratives within the corpus of architectural discourse. Furthermore, by modeling my teaching practice on Paulo Freire's pedagogical theory —as well as other postcolonial and decolonial thinkers— I am actively reforming the courses I teach by engaging in what I will call here an architectural pedagogy of the oppressed. My objectives are not only prompting a different teaching/learning approach to the survey course but also enabling teaching/learning spaces where the so-called "subaltern" can speak and teach as subaltern.[16] My aspiration is that the process of decolonizing the history of architecture curriculum pushes forth critically conscious architects who might be better equipped to design hopeful, emancipatory, futures.

Towards an architectural pedagogy of the oppressed

It seems more important than ever to guide future architects into becoming critically conscious practitioners. Freire defined the term "conscientização" as a process to help people learn to recognize the oppressions authority inflicts around them and against them; the ultimate objective being to intervene in the world to change it.[17] Many scholars, such as Manfredo Tafuri, Henry Lefebvre, Michael Foucault, and more recently, Arturo Escobar and Tony Fry have identified the ways in which architects and designers have historically aligned with Power by designing objects and experiences meant to/for discipline and control.

A subaltern pedagogical perspective or teaching position shifts "the epistemic location of [architecture history] narratives" by confronting and moving passed the imposed conventions of the Western canon.[18] Subalternation as methodology provides a particular situatedness for examining how domination operates through architecture and how the practice of design engages with it in order to reposition the way we approach the continuation of the profession. For instance, away from the ideological underpinnings of technology, capitalism, and/or development and towards more humanizing and solidary practices, particularly, in historically colonial settings like Puerto Rico, where architects hold an ambivalent position: sometimes as authority and others, as subaltern.[19]

Praxis, says Freire, is the exercise of "reflection and action upon the world in order to transform it."[20] In that sense, design may be recognized as a form of praxis depending on its intentions and outcomes, since, as the Brazilian theorist points out, "the pedagogy of the oppressed cannot be developed or practiced by the oppressors."[21] In that sense, both architecture students and professors should adopt and adapt to the position of the subaltern and, after critically confronting their local reality, contrary to the norm, be prompted to speak.[22]

As a counter teaching methodology to banking education, Freire suggests problem-posing. Problem-posing promotes the exchange and engagement between students and teachers while encouraging active questioning focusing, for instance, on the role of architects in society and the normalized notion of architectural practice as intrinsically good or heroic. A problem-posing architectural education, or one framed by profound inquiry, instead of predetermined building programs, types, or chronologically ordered objects on a timeline, recognizes the corpus as an ever-unfinished site that is always in construction and reconstruction. As such, problem-posing helps to slowly delink from the idea that architects' abstract knowledge alone can forecast externally programmed, fixed, universal futures. In the case of the history survey, as the present is problematized, looking at the past assists in recognizing ways in which transformative futures were/can be built not from a misleading sense of neutrality,[23] but from the purposeful identification of historical instances where architects, not willing to adapt, challenged their own presents. Although Freire did not refer directly to the teaching of

history courses, he implied that there is a non-conformist, transformative, power in history by explaining that "the fundamental issue is not if the past happened or not, but the critical, attentive way in which we may understand the presence of the past within the processes that are taking shape in the present."[24] In other words, problem-posing may lead to thinking with the past (and not merely about it) to confront the present and change the future.

Moreover, recognizing that a banking education is a model also grounded on patriarchy, Aurora Levin Morales' treatment of history as a form of healing and her definition of the historian as "curandera" (healer) provides, along with Freire's ideas, a suggestive point of view for historical interpretation that could connect architecture history surveys with the notion of reparation, but from a matristic perspective.[25] Following the writings of Humberto Maturana, a matristic pedagogical stance implies participation, inclusion, collaboration, understanding, and respect towards the objects of study.[26] All of these are aspects that correspondingly connect with Freire's viewpoint of a learning community engaged by/in humility, love, dignity, and hope. Additionally, a matristic pedagogical approach calls for interconnectedness, relationality, and the activation of emotions driven through informal conversations and the understanding of teaching/learning as acts of caring. In other words, connecting with decolonial sociologist and activist Silvia Rivera Cusicanqui, the familiar and ordinary would find a new place of value within the pedagogical exchange.[27] This could become a valuable approach for building history of architecture survey courses divorced from the Euro-US-androcentric paradigm and, as such, more diverse and inclusive.

Strategies

It was important for me to recognize the difficulties of introducing multiple subversions at once and to acknowledge that the process of reframing an established curriculum takes time. The first step to approaching the decolonization of these courses was to recognize and assimilate, from a personal process of unlearning, the ever-incomplete nature of the decolonizing pedagogical approach. So, I actively build the history of architecture surveys I teach from the notions and processes of construction and reconstruction. This means a constant revision of syllabuses following the idea of *bricolage*. Each semester, I add or subtract things depending on current issues, student profiles, and interests. Thus, courses are never monolithic and remain unfinished by design.

Critical history, framed by postcolonial and decolonial theory, inform all my courses. Because I teach in a professional program leading to practice, discussions strongly focus on the purpose of architecture and the role of architects in society. Additionally, history courses emphasize design problems and solutions contextualized by the multiple factors influencing practice at the time of conception and/or construction. Depending on the topic, posing questions such as what did the architect intend to do?; who were affected?; what does the building reveal and what does it conceal?; is the project mainly thought for the client or the users?; or how was the project financed? lend opportunities to talk about the present condition of practice. An important objective here is to be able to link the history of architecture surveys with design studio, as in Puerto Rico, these courses remain typically disconnected.

In addition, the survey courses I teach follow Edward Said's concept of contrapuntal reading.[28] Thus, questioning Euro-US-centric metanarratives such as, for example, the concepts of primitivism, modernity, development, and underdevelopment. This helps to reflect on the multiple biases still present in the history of architecture and design practice. Similarly, critically addressing these notions assists in identifying what academics have included and/or excluded from the corpus of architectural history and why, while probing official or normalized outlooks. This constant revision of content allows for the introduction of historically invisibilized and/or silenced groups, practices, and regions,

such as women, people of African descent, workers, migrants, and peasants, as well as ancestral construction practices, non-western ways-of-being-in-the-world, and relational practices. As mentioned, content expands and contracts depending on students' interests, inquiries, and current challenges identified in outlets such as the media.

It is vital to allow students to learn how to learn when first introduced to a pedagogical model that defies the banking paradigm. There are adjustments and readjustments by reviewing and redesigning exercises to reinforce the decolonial model and prompt critical thinking. Activities encourage students to share their own experiences, love, and indignation as relevant knowledge which may lead to the drawing of questions that can foster deep reflection on our present. A present that begins in history. Over the semester, I ask for students' input regarding content, context, and delivery. This information is helpful to design the courses around their interests, passions, curiosities, and outrage. As an example, for the architecture in Puerto Rico survey, students collaborate in drawing the outline of the syllabus over the first couple of weeks of the semester while suggesting topics of inquiry. One key objective is to articulate a situated discussion about the current state of architecture in Puerto Rico as informed by history. Collective discussion is framed by the notions of coloniality of power, of knowledge, of being, and of gender as defined by Aníbal Quijano, Nelson Maldonado Torres, and María Lugones, among others.[29] So, difference, identity, identification, culture, crisis, and struggle tend to serve as threads to question architectural development in Puerto Rico and the diaspora.

CONCLUSION

My experience as a young architecture student involved a banking pedagogy that was also extremely violent. Now, teaching at the same program I attended, I strongly believe teaching/learning should be forms of caring. This connects with the intentional framing of the courses I teach from the position of the subaltern. My aim is to actively use the history of architecture surveys to uncover, recover, highlight, and reveal the untold, hidden, or deformed narratives from a localized position of deliberate dissent by taking advantage of what Boaventura de Sousa Santos identifies as epistemologies of the South: "a set of inquiries into the construction and validation of knowledge born in struggle, of ways of knowing developed by social groups as parts of their resistance against the systematic injustices and oppressions caused by colonialism, capitalism, and patriarchy."[30] In that effort, I am reframing my history courses in order to delink from singly validating normative Euro-US-centric methodologies and themes.

As I discussed, my teaching tactic conceptually models Paulo Freire's pedagogy of the oppressed and follows a matristic perspective. Classrooms are hybrid pedagogical spaces where theory and practice can come together. Instead of erasing students' experiential knowledge, as normative architectural pedagogy usually intends to do, from a decolonial perspective, my objective is "to transform their lived experiences into knowledge and to use the already acquired knowledge as a process to unveil new knowledge…."[31] Within that aim, together, the students and I reflect on specific questions or topics by linking our discussions to the courses' readings and lectures as well as to our lives or those of others we may know. Open informal conversations provide a safer, less intimidating format for everyone to engage, as we learn from each other. My interventions within these conversations mostly focus on introducing critical observations which students might have missed, offering contrapuntal comments, clarifying certain misunderstood concepts, or guiding the discussion to maintain engagement.

Why is it that, within the Puerto Rican context, Euro-US-centrism remains so strong within the architectural academic context? Why is it that local architecture schools only limitedly question its narratives? Which ideologies and pedagogical frameworks still support and reproduce it? How can

we, the subaltern(ized), delink from its stronghold? Consciously situating myself in the position of the subaltern allows me to help guide my students' processes of "conscientização," while I keep working on my own unlearning. Prompting the questioning of the status quo with the assistance of the historical gaze, my classrooms are safe spaces where I welcome and encourage dissent. Classes are opportunities for members of our teaching/learning community to collectively negotiate different points of view, though always through respect and willingness to understand each other's positions.

With the advent of artificial intelligence, architectural pedagogy, and practice, as we know them, will soon change. At the same time, the political and socioeconomic landscape around the world compels us, teachers, and design practitioners, to be radically human. Neutrality, nor conformism are valid options in challenging and uncertain times. We must teach our students to question, to speak, to listen. We also must learn what moves, inspires, and disillusion them. Survival depends on it.

NOTES

[1] The courses are History of Architecture I: The Invention of the Classic; History of Architecture II: Genealogy of Modernity; History of Architecture III: Architecture and Contemporary Urbanism; and History of Architecture in Puerto Rico.
[2] National Architectural Accrediting Board (NAAB), *Conditions for Accreditation 2020 Edition, Revised March 19, 2026* (Alexandria, VA: NAAB, 2026), 2.
[3] Paulo Freire, *Pedagogy of the Oppressed,* trans. Myra Bergman Ramos (New York: The Continuum International Publishing Group, 2005) 72-75.
[4] Boaventura de Sousa Santos, "The University at a Crossroads," in *Decolonizing the Westernized University: Interventions in Philosophy of Education from Within and Without*, eds. Ramón Grosfoguel, Roberto Hernández and Ernesto Rosen Velásquez (Lanham: Lexington Books, 2016), 5-6.
[5] De Sousa Santos, "The University at a Crossroads," 4.
[6] Peruvian thinker Aníbal Quijano introduced and developed the concept arguing that Eurocentric definitions of what constitutes knowledge, as well as acceptable forms of production and outreach, were fundamental in the consolidation of an asymmetrical distribution of power which, while erasing, inferiorizing, devaluating, and deforming so called native, alternative, or marginal knowhows validated specific knowledge systems, such as academic, scientific, and/or technologic, as an epistemic hegemony. Aníbal Quijano, "Coloniality of Power, Eurocentrism, and Latin America," Nepantla: Views from the South,1.3 (2000): 533-580.
[7] See Luz Marie Rodríguez López and Yara Maite Colón Rodríguez, "Contra la pedagogía de la mímesis: Problematizar el ambiente construido desde la teoría de Paulo Freire," Arquitextos 256.03, year 22 (September 2021): https://vitruvius.com.br/revistas/read/arquitextos/22.256/8243.
[8] Although her focus was on denouncing patriarchy, my position follows Audre Lorde's as it fits the scope of my argument here: "*…the master's tools will never dismantle the master's house.* […] [They] will never enable us to bring about genuine change." Italics are from the original. Audre Lorde, "The Master's Tools Will Never Dismantle the Master's House: Comments at The Personal and the Political Panel (Second Sex Conference, October 29, 1979)," in *Writings by Radical Women of Color*, eds. Cherríe Moraga and Gloria Anzaldúa (New York: Kitchen Table: Women of Color Press, 1983) 99.
[9] Italics are from the original. Homi K. Bhabha, *The Location of Culture* (London: Routledge, 1994), 86
[10] Italics are from the original. Bhabha, 45.
[11] Walter Mignolo, "Forward. On Pluriversality and Multipolarity," in *Constructing the Pluriverse: The Geopolitics of Knowledge*, ed. Bernd Reiter (Durham: Duke University Press, 2018) ix-x.
[12] "Cuarta declaración de la Selva Lacandona," Comité Clandestino Revolucionario Indígena, Comandancia General del Ejército Zapatista de Liberación Nacional, accessed April 14, 2016. https://enlacezapatista.ezln.org.mx/1996/01/01/cuarta-declaracion-de-la-selva-lacandona/.
[13] Escobar introduces the concept into de practice of design. For the Colombian scholar, design can become a tool for imagining and rebuilding multiple worlds. However, these "life-enhancing" reimaginations need to delink from "dominant models of life and the economy…" as well as rearticulate the Western notion of knowledge. Arturo Escobar, introduction to *Designs for the Pluriverse: Radical Independence, Autonomy, and the Making of Worlds* (Durham: Duke University Press, 2018), 4-5, 8.
[14] Mignolo, ix-x.
[15] Marina Waisman, *El interior de la historia: Historiografía arquitectónica para uso de Latinoamericanos* (Bogotá: Escala, 1990), 72-73.
[16] Gayatri Spivak argues that subalternized, marginalized, oppressed groups are deprived of their capacity to speak by systems of domination that silence, distort, or choose to ignore their voices. Gayatri Spivak, "Can the Subaltern Speak?" in *Marxism and the Interpretation of Culture*, eds. C. Nelson and L. Grossberg (London: Macmillan Education, 1988), 271-313. On the other hand, Judy Harris explains that "to learn from the subaltern is to remain open to the possibility that what is learnt cannot be reconciled with the structures of modern subjecthood through reason…." Judy Harris, "Can the Subaltern Teach?" Interventions: International Journal of Postcolonial Studies 17.1 (2015): 149.
[17] Freire, *Pedagogy of the Oppressed*, 35.
[18] Carmen Fulco and Dalila Tatarevic, "Subaltern-centered Pedagogy: Field Notes and Reflections from Tunisia," Protest 4 (2024): 88.
[19] Yara M. Colón Rodríguez and Luz M. Rodríguez López, "After the Storm: A Post-Critical Stance on Practice for Puerto Rico's Reconstruction," in *Critical Practices in Architecture: The Unexamined*, eds. Jonathan Bean, Susannah Dickinson and Aletheia Ida (New Castle upon Tyne: Cambridge Scholars Publishing, 2020), 147-150.

[20] Freire, *Pedagogy of the Oppressed*, 51.
[21] Freire, *Pedagogy of the Oppressed*, 54.
[22] I will argue here that architectural representation and other non-conventional narrative forms, like storytelling, mapping, photography, or archiving should be acknowledged as forms of architectural speech.
[23] Freire, *Pedagogy of the Oppressed*, 34.
[24] Original text in Spanish. The translation is by the author. Paulo Freire, *Pedagogía de la indignación: Cartas pedagógicas en un mundo revuelto*, trans. Ana Laura Granero (Buenos Aires: Siglo Veintiuno Editores, 2012), 93.
[25] See Aurora Levin Morales, "The Historian as Curandera," JSRI Working Paper #40, The Julian Samora Research Institute, Michigan State University: 1998.
[26] Humberto Maturana Romesin, *Amor y juego: Fundamentos olvidados de lo humano desde el patriarcado a la democracia,* trans. Augusto Zagmutt and Alfredo Ruiz (Chile: JC Sáez Editor, 2003), 30-37.
[27] See Kattalin Barber, "Silvia Rivera Cusicanqui: 'Tenemos que producir pensamiento a partir de lo cotidiano,'" *El Salto*, February 17, 2019, https://www.elsaltodiario.com/feminismo-poscolonial/silvia-rivera-cusicanqui-producir-pensamiento-cotidiano-pensamiento-indigena.
[28] As a postcolonial analytic approach, contrapuntal reading was introduced by Said in *Culture and Imperialism* (1993). It may be applied to uncover what is commonly excluded from normative history of architecture and to dismantle the ways in which discourses of power have influenced architectural practice. Methodologically, a contrapuntal reading examines dominant architectural narratives as well as those silenced or subalternized.
[29] In addition to Quijano's work cited in note six, refer to Nelson Maldonado Torres. "On the Coloniality of Being: Contributions to the Development of a Concept," Cultural Studies, 21.2 (March 2007): 240-270 and María Lugones, "The Coloniality of Gender," in *The Palgrave Handbook of Gender and Development: Critical Engagements in Feminist Theory and Practice*, ed. Wendy Harcourt (London: Palgrave Macmillan, 2016), 13-33.
[30] Boaventura de Sousa Santos, *Epistemologies of the South: Justice Against Epistemicide* (New York: Routledge, 2016), 11.
[31] Donaldo Macedo, introduction to Paulo Freire, *Pedagogy of the Oppressed*, 19.

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DISRUPTING BLOOM'S TAXONOMY: RETHINKING LEARNING IN DESIGN EDUCATION

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INTRODUCTION

The advent of Generative AI (GenAI) has precipitated a fundamental disruption in design pedagogy, creating a phenomenon we define as the "Polished Paradox." In this state, design students produce expert-level, high-fidelity artifacts while simultaneously struggling with entry-level conceptual understanding. Traditionally, the visual quality of a design output served as a reliable proxy for cognitive maturity. GenAI has severed this link. By decoupling the *product* of design from the *process* of learning, these tools allow students to simulate mastery without the friction of foundational internalization. Nigel Cross[1] argues that 'designerly ways of knowing' are built on the synthesis of code-breaking and code-making.

This disruption challenges the very architecture of learning frameworks used in design education, specifically Bloom's Taxonomy.[2] As noted by Galla, Cope, and Kalantzis,[3] GenAI effectively "inverts" the taxonomy. Algorithms now excel at the summit of the pyramid, *Creation*, while the student is left to navigate the lower levels of *Understanding* and *Applying* in reverse. This inversion creates a pedagogical crisis: students are engaging with high-order visual synthesis before they have acquired the vocabulary to critique, justify, or even understand the images they have generated.

This paper investigates this inversion through an empirical study of "Digital Storytelling" cohorts. It examines how the immediate accessibility of high-quality outcomes tempts students to bypass the "struggle" of foundational learning, specifically the stages of *Remembering* and *Understanding*. We argue that this is not merely a technological shift but a structural collapse of the traditional "ladder" of academic maturity mandated by current educational policies.

THEORETICAL FRAMEWORK & CONTEXT

In the context of Indian higher education, Bloom's Taxonomy is not merely a pedagogical guide; it is a structural mandate for accreditation. The University Grants Commission's (UGC) *Evaluation Reforms in Higher Education Institutions*[4] enshrined this hierarchy as the definitive metric for student competency. By underpinning the Learning Outcomes-based Curriculum Framework (LOCF), this policy enforces a linear promise: academic maturity is a ladder. It assumes that mastery of Lower Order Thinking Skills (LOTS), such as *Remembering* and *Understanding*, is a non-negotiable prerequisite for engaging with Higher Order Thinking Skills (HOTS) like *Creation*.

This assumption lies at the heart of the National Higher Education Qualifications Framework (NHEQF), which calibrates student progress from Level 5 to Level 10 based on this cognitive ascent.

A student who produces sophisticated design outputs is presumed to have internalized the foundational syntax required to create them. However, the emergence of Generative AI challenges this logic by rendering the "ladder" obsolete.

The Inversion of Competency

Recent scholarship suggests that AI does not merely accelerate this hierarchy; it structurally inverts it. Galla, Cope, and Kalantzis argue that Generative AI models excel precisely where novice students struggle: at the peak of the pyramid (*Creation* and *Synthesis*). Conversely, these models frequently fail at the base (*Factual Recall* and *Contextual Application*). When students utilize these tools, they effectively "parachute" to the top of Bloom's Taxonomy, producing high-fidelity artifacts without traversing the cognitive steps traditionally required to reach that altitude. In doing so, they leapfrog what Vygotsky[5] termed the 'Zone of Proximal Development' (ZPD), erasing the essential scaffolding provided by failure and iteration.

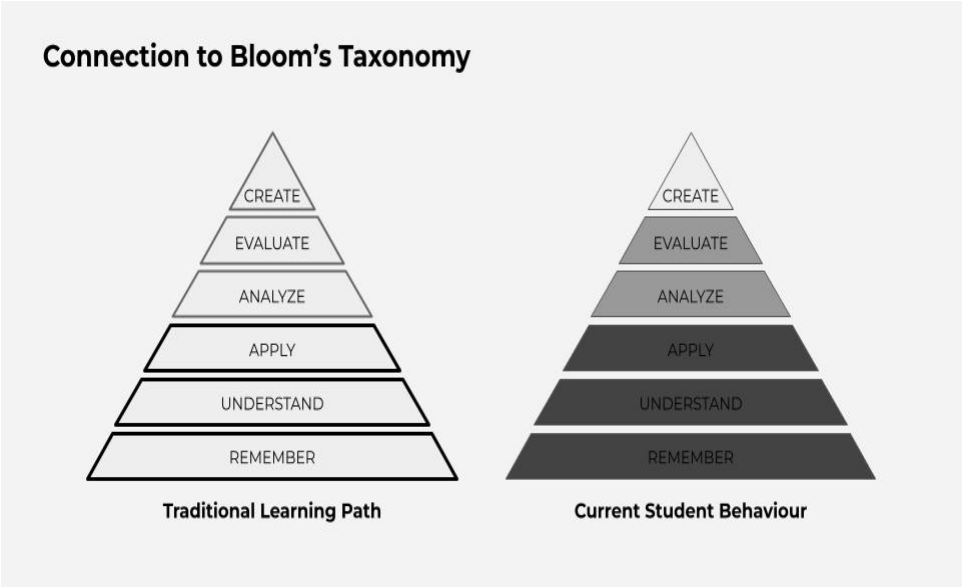


Figure 1. Current shift in application of Bloom's Taxonomy in Design Education (the darker shade indicates the disruption of the Lower Order of Thinking Skills)

This creates a critical gap in what Rana, Verhoeven, and Sharma[6] described as "Epistemic Vigilance." In their analysis of GenAI in Design Thinking, they note that while AI democratizes creativity, it risks producing "passive users" who lack the ethical and critical reasoning to validate the machine's output. Without the "struggle" of the lower levels of Bloom's, where students traditionally learn the constraints of their discipline, learners are ill-equipped to perform the necessary *Evaluation* of the AI-generated artifact.

The Crisis of Melioration

This disconnect highlights a new pedagogical imperative. Gonsalves[7] proposes that in an AI-driven environment, the primary cognitive skill is no longer *Generation* but *Melioration* - the ability to refine, correct, and improve algorithmic outputs. However, the current Indian regulatory framework (LOCF) has no metric for this. It continues to reward the *product* (the final design) rather than the *process* (the interrogation of the design).

Consequently, we are witnessing a regulatory failure: the LOCF measures the quality of the output as proof of learning, while the technology allows the output to be decoupled from the learner's cognition.

This study, therefore, operates at the friction point between this linear policy mandate and the recursive reality of the AI-augmented classroom.

THE RESEARCH INQUIRY

Given the theoretical disconnect between the LOCF's linear mandate and the algorithmic reality, this study aims to empirically map the "Polished Paradox." We specifically target three critical dimensions of design competency[8] that are most vulnerable to this inversion:

1. Articulation of Design Principles: Can students analyze and describe their work using formal design syntax (hierarchy, balance, rhythm), or do they rely on the tool to generate the description?
2. Justification of Decisions: Can students defend their creative choices against objective constraints, ensuring that the output is intentional rather than an algorithmic accident?
3. Strategic Adaptation: We measure the student's agility in modifying AI-generated outputs when faced with sudden changes in context (e.g., a new target audience), testing if they control the tool or if the tool controls them.

This inquiry asserts that if students cannot perform these three tasks, the "creation" phase has not actually occurred - it has merely been simulated.

METHODOLOGY: MAPPING THE COGNITIVE GAP

Context and Participants

This study was conducted with approximately 121 students enrolled in a Digital Storytelling module along with 40 faculty members involved in studio-based teaching. The diversity of the sample enabled analysis across varying levels of academic maturity and temporal structures:

- Bachelor of Design (B.Des): An intensive 2-week course focusing on foundational visual storytelling.
- Master of Design (M.Des): An intensive 2-week immersion focusing on complex narrative structures.
- Minors Program (Interdisciplinary): A distributed 45-hour program running throughout the semester, allowing for longitudinal observation.

Data was collected through a combination of online surveys, classroom observations, and analysis of student project submissions. In addition, informal discussions with faculty during critique sessions supplemented the qualitative insights. The survey included a mix of Likert-scale questions (e.g. frequency of AI usage) and open-ended questions exploring students' perceptions of learning and authorship. The qualitative data was analyzed using thematic analysis, in which recurring patterns in student responses and behaviors were identified and grouped into key themes.

Study Design: The Triad of Assessment

To identify the "Polished Paradox," the pedagogical structure was designed to grant students autonomy over their toolset. The use of Generative AI was neither mandated nor prohibited; instead, the production pipeline was monitored through Continuous Internal Evaluation (CIE) stages.

We employed a Comparative Triangulation Method, contrasting the student's *intent* against their *output* through three critical dimensions:

- Explanation (The Word): How the student articulated their intended narrative structure and design logic prior to execution.
- Execution (The Output): The structural integrity of the final digital artifact (storyboards, animations, interactive sites).
- Evaluation (The Critique): The student's ability to objectively critique their own work and justify specific design decisions against the initial intent.

Quantitative Findings: The Digital Divide

Data gathered through faculty and student surveys reveals a stark contrast between the student's reliance on digital tools and the faculty's valuation of analog skills.

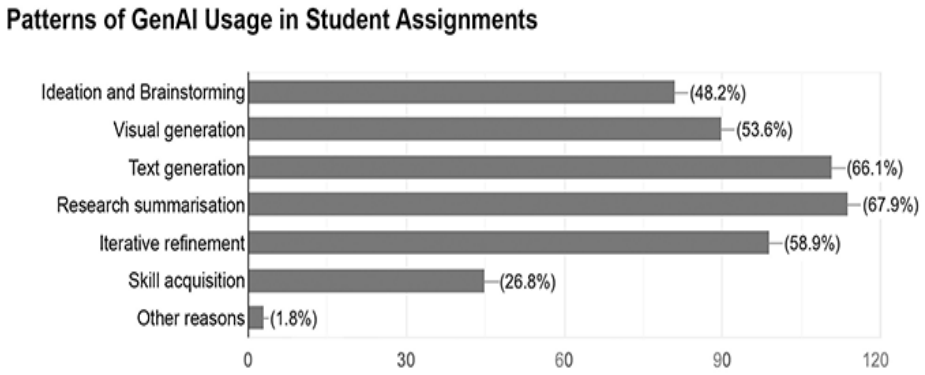


Figure 2. Student-Reported Uses of Generative AI in Coursework

The Student Workflow - Cognitive Outsourcing: The modern design student's narrative begins with digital immersion. With 80% of the cohort integrating Generative AI into their daily tasks, the tool has transitioned from an optional novelty to a fundamental utility. However, as Neil Selwyn[9] warns, the integration of digital tools often prioritizes 'efficiency' over 'engagement.' Our data confirms this, showing a skew heavily toward cognitive outsourcing:

- The Inception Gap: Dependency begins at the research stage. 68% of students use AI to summarize research materials, effectively bypassing the traditional synthesis of reading.
- The Production Paradox: As projects progress, reliance shifts from visual creation to linguistic support. A critical finding is that 66% of students rely on AI to generate text for project descriptions and justifications - significantly exceeding the 54% who use it for final visuals. Students are using the tool to "reverse engineer" the rationale for their work, acting as prompt editors rather than authors.

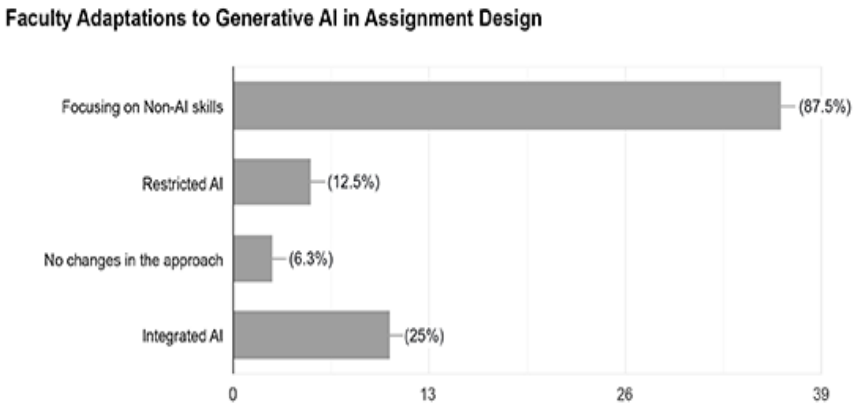


Figure 3. Faculty Adaptations to Generative AI in Assignment Design

The Faculty Perspective - The Competency Crisis: While students digitize their workflows, the pedagogical environment remains rooted in analog fundamentals. A commanding 88% of faculty

explicitly prioritize non-AI skills (manual sketching, process documentation) as the primary measures of performance. This disconnect has led to tangible friction in the classroom:
- The Articulation Crisis: 56% of faculty observe that students who rely heavily on AI struggle to articulate design principles effectively without assistance.
- The Justification Void: Even more concerning, 63% of educators note that these students cannot adequately justify their creative choices. When the algorithm generates the rationale, the learner loses the ability to defend the work.
- Erosion of Foundations: Ultimately, 81% of faculty report that AI integration has decreased overall engagement with foundational skills, confirming that while output speed has increased, the underlying learning process has decelerated.

THE SPECTRUM OF COGNITIVE AGENCY

Our observation of the production pipeline revealed three distinct archetypes of student behaviour in the digital storytelling course, which together form a spectrum of cognitive agency in AI-mediated learning. These archetypes range from high human control and low AI dependency to low human control and high AI dependency.

1. The Architects (Manual Creators): A minority of students opted for a fully manual workflow. While their production was slower, their engagement with Bloom's Taxonomy was linear and complete. When errors occurred, these students demonstrated the ability to *classify* and *differentiate* the error (Understanding) and *modify* their technique to rectify it (Applying). This mirrors what Donald Schön[10] defined as 'reflection-in-action,' where the designer engages in a continuous conversation with the situation, allowing the drawing to 'talk back' to them. Their final outcome was a direct result of intentionality; every pixel was a decision they owned.



Figure 4. Images of Digital Stories created by students (Hitha Shetty, Group 1 - Bora Durva Sachin, Komal Lalawani, Mohammed Rihan, Sumit Raj, Group 2 - Aryan Sharma, Chirag A, Kushal G) without using GenAI

2. The Drifting Directors (The Hybrid Paradox): This cohort represents the most critical finding. These students utilized AI for specific steps like scriptwriting or storyboarding, but attempted to retain creative control. However, their work revealed significant "Hallucinations of Competence."

- Narrative Drift: Students often accepted AI-generated deviations from their original scripts because they lacked the vocabulary to prompt a correction.
- The Justification Gap: During critiques, these students frequently presented sophisticated compositional techniques - such as Dutch Angles or the Golden Spiral - in their storyboards. However, when pressed, they could not explain *why* those angles were used or how they impacted the narrative. The composition was a statistical accident of the algorithm, not a design choice.

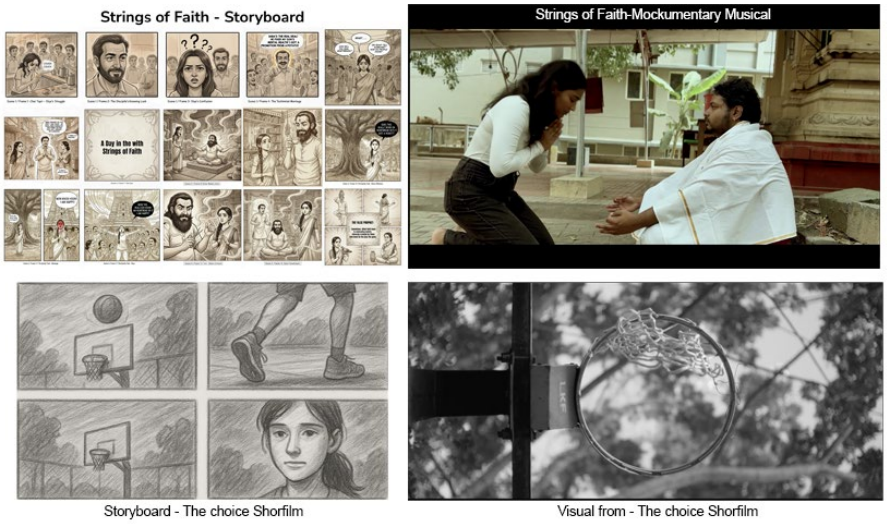


Figure 5. Images of Digital Stories created by students (Strings of Faith - Aniruddha A Shanbhag, Drishty Srivastava, Pratishtha Mandal. The Choice - Humaira Sheikh) by using GenAI for pre-production and shooting manually.

3. The Curators (Full Dependency): The final group relied entirely on AI, effectively outsourcing the *Creation* phase. A stark case study revealed students who generated scripts and storyboards that were logically incoherent yet visually stunning. These students could justify the *theme* of the visuals but admitted that the composition was entirely out of their control. The final artifact was "better" than what they could make, but it was not what they had planned to create.

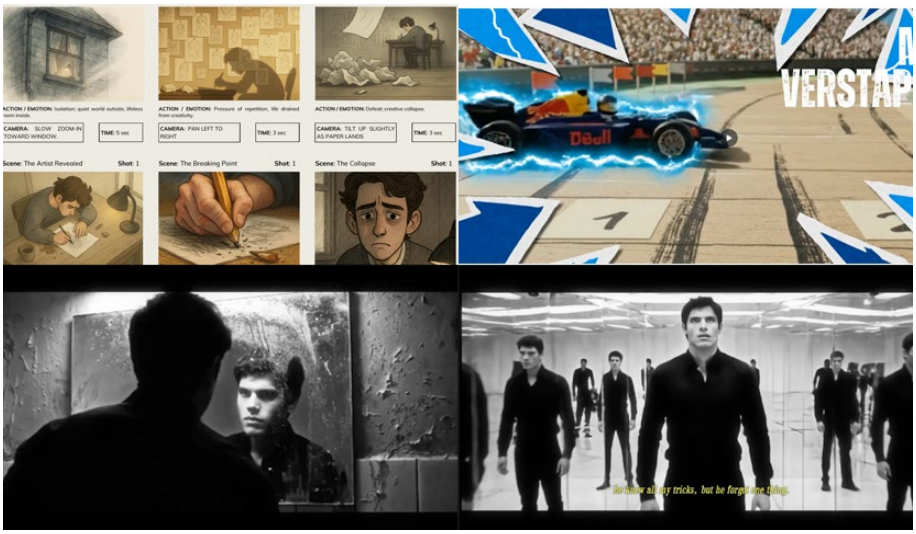


Figure 6. Images of Digital Stories created by students (Group 1 - Aanupam Deb Baag, Tara Verma, Neha Sujeeth. Group 2 - RahulJ, SubhashiniRamesh, ThaanyaKS, VenkataSumanthAppari. Group 3 - Rachit Rahavendran Rao, Vedanth Meyyappan) completely by using GenAI.

Together, these archetypes constitute a spectrum of cognitive agency, illustrating how generative AI shifts students from producers of meaning to managers of output.

Productive uses of GenAI

While much of the analysis highlights the risks of superficial engagement, several students reported that generative AI also supported learning by accelerating iteration, exposing them to professional visual standards, and enabling experimentation beyond their existing technical skills. For some learners, AI functioned as a creative scaffold, allowing rapid prototyping and exploration of alternative narrative directions.

However, without structured reflection and critical interrogation, these benefits often remained surface-level. The speed and polish of AI-generated outputs frequently replaced, rather than reinforced, deeper processes of conceptual reasoning and skill acquisition.

DISCUSSION - THE RECURSIVE MODEL

Restructuring Bloom's: From Ladder to Loop

The fundamental architecture of Bloom's Taxonomy relies on linear dependency. It presupposes that cognitive skills are stacked like bricks; one cannot place the capstone of *Creation* without first laying the foundation of *Understanding*. In a manual world, this was physically true - a student could not render a complex perspective without first understanding the geometry of space. However, our findings demonstrate that Generative AI allows students to "parachute" directly to the top, creating "Level 6" artifacts with "Level 0" knowledge.

Since we cannot prevent students from bypassing these Lower Order Thinking Skills (LOTS), the pedagogical response must be to relocate where those skills occur. We propose shifting the pedagogical model from a "linear climb" to a "Recursive Loop." In this model, *Creation* is not the final destination; it is merely a raw material for *Analysis*.

The New Framework: Conceptualize, Consult, Refine

This framework is designed to sandwich AI generation between layers of critical human thought. It compels students to be architects before they become prompt engineers and critics before they are authors.

1. **Conceptualize:** The greatest risk of AI is that it replaces human intent with algorithmic probability. Therefore, the first step is strictly analog. Before opening any software, students must visualize the narrative, mood, and message. This step reclaims the Remembering level: students must access their own mental library of references and ideas without external interference. They must define the "Why" before the machine provides the "How."
2. **Consult:** Ideas in isolation are fragile. In this phase, students must "socialize" their concepts by consulting with peers, mentors, or existing case studies. This acts as the new Understanding layer. By articulating their abstract ideas to a human team, students structure their thoughts into a defensible plan. This ensures that the subsequent prompt is not a vague guess but a specific request.
3. **Refine:** Based on consultation, students refine their approach. They must align their concepts with the intended impact. This is the strategic planning phase where students decide which tools to use and how to guide the AI. It prevents the "lazy prompting" observed in our findings, replacing it with intentional design strategy.
4. **Analyze:** Only now does the generation occur. However, the pedagogical goal shifts immediately from production to inspection. Students must dissect the AI-generated artifact. Does the lighting support the narrative? Is the character acting consistent with the script? This forces students

to engage in Analysis—not of their own handiwork, but of the machine's output. They become the quality control officers for the algorithm.

5. **Evaluate:** If the analysis reveals flaws, students must evaluate the input mechanism. The failure is not treated as a glitch but as a failure of communication. They must judge their prompting syntax and logical parameters. This turns the "Hallucination" into a learning moment, compelling students to understand the underlying logic of the tool to fix the error.

6. **Co-Create:** Finally, students arrive at the final output. This is no longer just "Creation" it is Co-Creation. It is a synthesis of human intent and machine execution, but crucially, it has been validated by rigorous steps of consultation and evaluation. The final artifact is not just a visually appealing piece; it is a decision that has survived scrutiny.

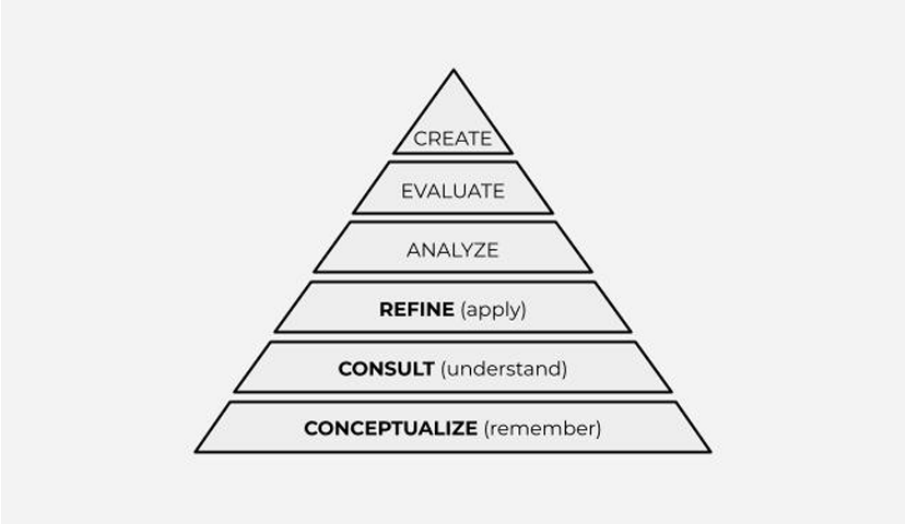


Figure 7. The New Proposed Framework of Bloom's Taxonomy

Limitations

This study is bounded by its specific geographical and cultural context within an Indian design institution. While the "Polished Paradox" is driven by universally available tools (Midjourney/ChatGPT), the student response is influenced by the specific pedagogical mandates of the Indian UGC. Future research is required to validate if this "Inversion" manifests identically in educational systems with different regulatory frameworks.

CONCLUSION

This study began with an inquiry into the "Polished Paradox." Our findings confirm that Generative AI has fundamentally decoupled the *product* of design from the *process* of learning. In the traditional pedagogical model, broadly adopted under the UGC's framework, the difficulty of execution served as the primary proof of understanding. Today, that validation has vanished.

The emergence of the "Drifting Director" archetype signals a crisis in what Nigel Cross defined as "Designerly Ways of Knowing." If the machine controls the *codes* of creation, the student must control the *logic* of application. If we fail to pivot, we risk graduating a generation of designers who are technically prolific but conceptually hollow—proficient with tools but paralyzed by original thought.

To counter this, design education must invert its priorities. In an AI-driven world, the high-order skills of Bloom's Taxonomy—specifically Evaluation, Analysis, and Justification—must become the new

entry-level foundational skills. We must shift our focus from "Reflection-on-Action" to what Donald Schön might call "Reflection-on-Algorithm."

Ultimately, these findings suggest several implications for design education in AI-mediated learning environments. Specifically, institutions should shift assessment to prioritize the process and justification of design decisions over final visual output, thereby ensuring that studio critiques focus on decision logic rather than aesthetic polish alone. Furthermore, early-stage courses may benefit from strategically restricting the use of generative AI for production while encouraging its use for research and ideation. Unlike disciplines such as science or mathematics, where foundational learning begins at the school level, design education typically starts at the university stage, making students especially vulnerable to disruptions in early cognitive scaffolding caused by generative AI. Finally, students must be explicitly trained in prompting as a reflective practice, and curriculum design must incorporate structured moments of metacognition and reflection to counter the risks of superficial engagement.

The difficulty of *making* has been solved. We must now embrace the difficulty of *meaning*.

NOTES

[1] Nigel Cross, *Designerly Ways of Knowing* (London: Springer, 2006).
[2] Benjamin S. Bloom, *Taxonomy of Educational Objectives: The Classification of Educational Goals. Handbook I: Cognitive Domain* (New York: David McKay Company, 1956).
[3] Michele Galla, Bill Cope, and Mary Kalantzis, "Generative AI Turns Bloom's Taxonomy Upside-Down: Implications for Creativity and Learning," in *Future of Learning 2025 Proceedings* (Champaign: Common Ground Research Networks, 2025)
[4] University Grants Commission, *Evaluation Reforms in Higher Education Institutions* (New Delhi: University Grants Commission, 2019)
[5] Lev S. Vygotsky, *Mind in Society: The Development of Higher Psychological Processes* (Cambridge, MA: Harvard University Press, 1978).
[6] Vishal Rana, Bert Verhoeven, and Madhav Sharma, "Generative AI in Design Thinking Pedagogy: Enhancing Creativity, Critical Thinking, and Ethical Reasoning in Higher Education," *Journal of University Teaching & Learning Practice* (2025)
[7] Chahna Gonsalves, "Generative AI's Impact on Critical Thinking: Revisiting Bloom's Taxonomy," *Journal of Marketing Education* (2024)
[8] Peter Kahn et al., "Teacher Agency and Generative Artificial Intelligence: Teaching in Higher Education as a Responsive, Cultural Activity," *Learning, Media and Technology* (2025)
[9] Neil Selwyn, *Is Technology Good for Education?* (Cambridge: Polity Press, 2016).
[10] Donald A. Schön, *The Reflective Practitioner: How Professionals Think in Action* (New York: Basic Books, 1983).

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MINA ZAYED: TOWARDS SENSIBLE INTERVENTIONS

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INTRODUCTION

Adaptive reuse has emerged as a critical architectural strategy in response to the growing recognition that contemporary urban development must reconcile environmental responsibility, cultural continuity, and social relevance. As many cities worldwide cope with the consequences of industrial decline, the reuse of existing building stock has always been regarded as an alternative to demolition-led regeneration, reactivating latent spatial, material, and cultural value. Beyond its environmental benefits, adaptive reuse enables architecture to operate as a mediator between past and future, allowing existing structures to be reinterpreted through new programs, users, and forms of occupation. In this sense, adaptive reuse is not merely a technical or economic solution, but a fundamentally socio-political act that reshapes how cities remember, transform, and project themselves forward.[1]

Within architectural education, adaptive reuse presents a compelling pedagogical framework. Working with existing buildings introduces constraints absent from typical design studios, demanding attention to structural systems, material limitations, historical narratives, and community expectations, and fostering a critical approach that balances preservation with intervention. This paper argues that adaptive reuse can function simultaneously as a design methodology and a pedagogical instrument, particularly in industrial urban contexts undergoing active transformation. Using Mina Zayed in Abu Dhabi as a teaching ground, the paper positions the site as a living laboratory where students confront industrial heritage, evolving urban agendas, and cultural production in a rapidly changing city, framing adaptive reuse not as a stylistic exercise but as a process of negotiation between existing fabric and new programs, institutional visions and community use, and speculative futures and material realities.

The paper is structured as follows. The first section provides a historical and urban overview of Mina Zayed, situating the district within Abu Dhabi's broader development trajectory. The second section outlines the theoretical foundations of adaptive reuse, focusing on industrial-to-cultural transformations. The third section examines key precedents at both international and regional scales, establishing a contextual framework for understanding local interventions. The fourth section presents Mina Zayed as a pedagogical case study, discussing architecture and interior design studio projects developed at Abu Dhabi University and Zayed University. Through selected student work, this section illustrates how adaptive reuse principles are translated into spatial, material, and programmatic strategies. The paper then concludes with a reflection on the implications of teaching adaptive reuse within real urban contexts, highlighting its potential to inform both architectural education and future urban regeneration practices

Historical Context and the Industrial Legacy of Abu Dhabi

Mina Zayed, also known as Port Zayed, occupies a pivotal position in the historical and economic development of Abu Dhabi. Officially inaugurated in 1972 and named after Sheikh Zayed bin Sultan Al Nahyan, the port was conceived as a central component of the emirate's modernization agenda, supporting the expansion of maritime trade and economic diversification during the early decades of nation-building.[2] Strategically located on the northeastern edge of Abu Dhabi Island, as illustrated in Figure 1, Mina Zayed functioned for decades as the city's principal commercial port, facilitating the import and export of goods and anchoring Abu Dhabi's integration into regional and global trade networks.

Throughout the late twentieth and early twenty-first centuries, Mina Zayed underwent successive infrastructural upgrades to accommodate growing trade volumes, evolving logistics technologies, and larger vessels. These included expanded berthing facilities, improved cargo-handling systems, and diversified maritime services. The port's role in supporting key sectors, particularly construction, manufacturing, and energy, contributed directly to Abu Dhabi's transformation into a major commercial and industrial center. The opening of Khalifa Port in 2012 marked a strategic realignment of maritime infrastructure at the metropolitan scale, as container traffic was relocated to a purpose-built deep-water facility designed for high-capacity global shipping. This shift reflects broader international trends in port development, in which older urban ports are increasingly losing their primary logistical function as new mega-ports emerge on metropolitan peripheries.[3]

Despite this functional transition, Mina Zayed has retained its significance through its continued operation as a cargo port, a cruise terminal, and an urban maritime interface. More importantly, the district surrounding the port has evolved into a socially and culturally active urban area, characterized by long-established markets and everyday commercial practices. This coexistence of industrial infrastructure, local commerce, and emerging cultural initiatives positions Mina Zayed as a complex urban condition, well-suited to adaptive reuse and regeneration strategies.



Figure 1. Mina Zayed located at the north-east end of the city of Abu Dhabi.

In 2007, Abu Dhabi released the 2030 Vision, a comprehensive strategic framework to guide the city's urban development over the next few decades. This plan was developed to ensure sustainable growth, economic diversification, and improved quality of life for its residents. As part of the plan, Mina Zayed, or "Al Mina" as it is named in the report, was identified as a high-density area with supporting mixed-use and commercial activities. The area was also cut through with canals to emphasize its connection with the water and to increase the livable area for the communities.[4] The map in Figure 2 represents the proposed planning scheme for the area as per the report.

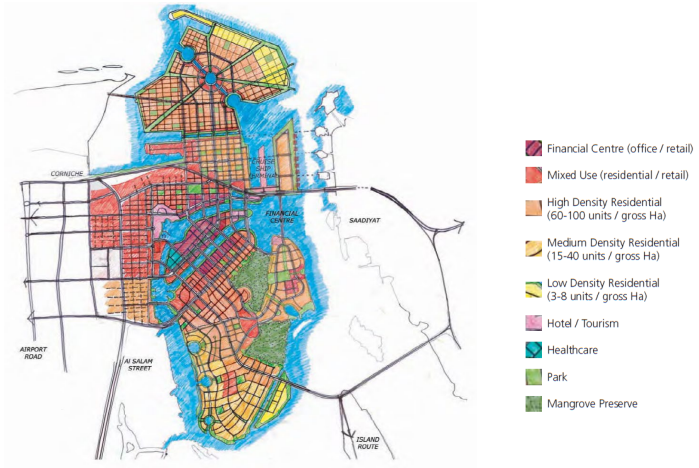


Figure 2. Abu Dhabi 2030 planning proposal, where Mina Zayed (Al mina) area is dedicated to a high-density residential zone with supporting commercial activities (source: Abu Dhabi Urban Planning Council 2007).

However, subsequent socio-economic shifts prompted a reconsideration of the original planning vision for Mina Zayed. In response, a portion of the district has been rebranded as MiZa and is currently undergoing an ambitious redevelopment process led by the London-based practice Allies and Morrison,[5] in collaboration with several international and local architecture firms, including BDP,[6] and WaiWai.[7] The proposed masterplan seeks to transform the area surrounding the port into a mixed-use cultural and commercial hub that supports creative production, innovation, and public life. The development accommodates a diverse range of programs, including educational facilities, incubators and co-working spaces, galleries, event venues, residential units, and supporting retail and public amenities, to foster a dynamic and inclusive urban environment.

The MiZa masterplan retains the port's warehouse typologies, street patterns, and industrial structures, introducing incremental interventions that improve permeability and waterfront access rather than replacing the existing urban fabric. Through refurbishment, selective insertion, and limited new construction, the framework aligns heritage continuity with Abu Dhabi's evolving needs, positioning adaptive reuse as its central strategy. Figure 3 illustrates the proposed masterplan by Allies and Morrison. Figure 3 illustrates the proposed masterplan developed by Allies and Morrison.



Figure 3. Context of MiZa and proposed massing of the masterplan by Allies and Morrison (source: Allies and Morrison 2019).

THEORETICAL FOUNDATIONS OF ADAPTIVE REUSE AND URBAN REGENERATION

Adaptive reuse is the process of repurposing existing buildings for new uses while retaining and reinterpreting their architectural, structural, and historical characteristics. Rather than treating ageing or obsolete structures as expendable, the approach positions the existing built fabric as a valuable

resource capable of accommodating contemporary spatial, social, and economic demands. The concept gained prominence from the 1970s onward as a response to the limitations of modernist planning, characterized by large-scale clearance and replacement. Growing conservation movements, coupled with increasing awareness of environmental degradation and resource scarcity, challenged the logic of urban renewal and prompted a reconsideration of the value embedded in existing structures. As a result, adaptive reuse emerged as a means of preserving architectural and cultural continuity while reducing construction waste, lowering embodied energy use, and minimizing the environmental impact of new construction. In many cases, reusing existing buildings has proven more cost-effective than new development, particularly in dense urban contexts with established infrastructure and strong real estate markets. For these reasons, adaptive reuse has gained broad recognition as a sustainable and culturally responsible alternative to demolition-led development, especially where large stocks of industrial or heritage buildings remain underutilized.[8]

Beyond technical and economic considerations, adaptive reuse demands innovative design strategies that reconcile the constraints of existing structures with new programmatic requirements. Industrial buildings offer significant spatial flexibility through their structural regularity, generous ceiling heights, and open-plan configurations, enabling a wide range of uses from exhibition halls to residential units and innovation hubs. Ultimately, adaptive reuse serves as a mediating practice that balances modernization with heritage preservation, positioning architecture as an active agent in shaping sustainable, culturally grounded urban futures. A variety of strategies can be employed in the adaptive reuse of industrial buildings, particularly when the aim is to transform industrial legacy into a catalyst for innovation and urban regeneration. Robiglio's *RE-USA* toolkit[9] offers a structured methodology that articulates adaptive reuse as a phased and value-driven process. Key strategies defined within this framework include:

- **Exploring possibilities:** Identifying reuse opportunities through mapping tools and spatial analysis to locate abandoned, vacant, or underutilized industrial assets at both building and urban scales.
- **Assessing potential:** Evaluating the feasibility of reuse based on factors such as location, scale, structural capacity, and accessibility, while adopting an incremental strategy of value creation that allows buildings to evolve over time rather than requiring complete transformation at once.
- **Envisioning the future:** Developing a positive and forward-looking vision that aligns reuse interventions with broader local and global trends, such as the circular economy, sustainability agendas, and innovation-driven development, to stimulate regeneration even in marginal or declining areas.
- **Designing to reuse:** Adapting new programs (content) to existing buildings (containers) through design approaches that prioritize maximum conservation and minimal transformation, thereby preserving material, spatial, and cultural value.
- **Leveraging industrial features:** Capitalizing on the inherent "structural DNA" of industrial buildings, such as robust construction systems, regular grids, and utilitarian materiality, to reduce costs, enhance flexibility, and create architectural identity through hybridization and spatial superposition.

Together, these strategies frame adaptive reuse as a deliberate and context-sensitive process that balances economic feasibility, architectural integrity, and long-term urban resiliency.

From Industrial to Cultural: Warehouse 421 as Catalyst for Urban Transformation

The adaptive reuse of industrial buildings for cultural purposes transforms obsolete structures into active civic spaces such as museums, galleries, performance venues, and community centers, without erasing their industrial heritage. Key considerations include preserving architectural integrity, conducting structural assessment, improving energy efficiency, and engaging the community to

ensure social relevance and long-term viability. When successfully executed, such transformations deliver overlapping benefits: cultural enrichment, economic revitalization, environmental conservation, and the safeguarding of heritage values.[10]

Internationally, projects such as the Tate Modern in London and Dia Beacon in New York exemplify how large-scale industrial structures can be reinterpreted as major cultural institutions. In both cases, the retention of expansive volumes, structural frameworks, and industrial materiality enabled flexible exhibition spaces while maintaining a strong connection to the buildings' past, acting as catalysts for economic development and urban regeneration. These projects also underscore the inherent challenges of adaptive reuse, including high renovation costs, regulatory constraints, and the careful negotiation between historic fabric and contemporary intervention.

Within the UAE context, Alserkal Avenue in Dubai provides a significant regional precedent for industrial adaptive reuse as a driver of cultural production and urban regeneration. Located in the Al Quoz industrial area, the project was initiated in 2007 with the aim of establishing a dedicated platform for arts and culture within a warehouse district. Over time, the incremental transformation of industrial units into galleries, studios, and creative spaces enabled Alserkal Avenue to evolve into a vibrant cultural district.[11] Following its initial success, the complex expanded in 2015 to include additional galleries, performing arts venues, and retail and dining facilities, further consolidating its role as a cultural hub. This phase also introduced *Concrete*, a flexible exhibition and performance space designed by the Office for Metropolitan Architecture (OMA).[12]

As illustrated in Figure 4, Alserkal Avenue has developed a distinct architectural identity rooted in a minimalist industrial aesthetic, characterized by open-plan interiors, generous ceiling heights, and natural light derived from the original warehouse typologies. Rather than erasing this utilitarian character, the approach preserves exposed structural elements such as steel beams, concrete floors, and expansive openings, while selectively introducing contemporary interventions. New warehouse-style buildings mirror the proportions and materiality of the original units, maintaining a consistent architectural language that reinforces industrial heritage while providing flexible environments suited to the display and production of contemporary art.[13]

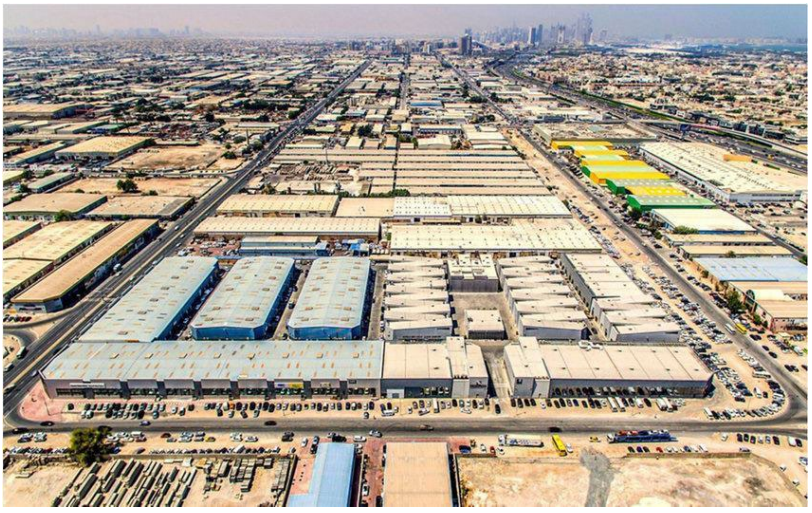


Figure 4. Aerial view of Alserkal Avenue showing old structure on the left and new addition on the right in Al Quoz area in Dubai (source: Grinstead 2021).

In Abu Dhabi, the revitalization of Mina Zayed, the focus of this research, emerged over the past decade as a locally driven initiative to reinvigorate the former port district. A pivotal moment in this process was the establishment of Warehouse 421, completed in 2016 and designed by the Danish

practice Bjarke Ingels Group (BIG). The project can be regarded as both the seed and catalyst of the broader transformation currently unfolding in the area. Warehouse 421 transforms two adjacent industrial warehouses into a contemporary art space accommodating exhibitions, workshops, performances, and public events, functioning as a platform for creative practices on the Mina Zayed waterfront. As illustrated in Figure 5, the design preserves the character of the existing structures while introducing contemporary interventions that reference local architectural traditions, most notably through newly inserted courtyards that improve daylight, permeability, and environmental performance, and perforated corten steel panels that echo the weathered textures of the surrounding port. Together, these spatial and material strategies create a flexible and inviting cultural facility that the architects describe as a contemporary reinterpretation of architectural elements drawn from the traditions of the Arabian Peninsula.[14]

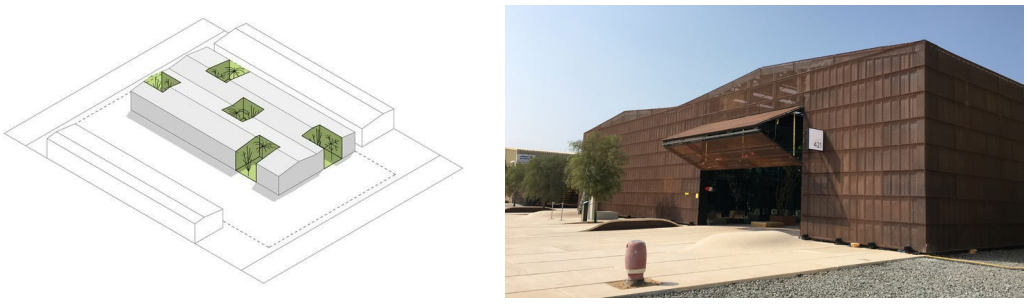


Figure 5. Design concept diagram of Warehouse 421 showing how courts are cut through the existing structure, and exterior view with perforated corten steel cladding (source: afasia archzine, n.d, Author).

PEDAGOGICAL FRAMEWORKS IN THE CONTEMPORARY DESIGN STUDIO

Adaptive reuse has been embedded within architecture studios at Abu Dhabi University and interior design studios at Zayed University as a central pedagogical framework. Students are introduced to the conceptual and ethical foundations of repurposing historically and culturally significant structures, with sustainability as a core learning outcome that informs decisions on space planning, material reuse, and environmental performance. Through precedent analysis, case-study research, and site-based investigation, students develop the critical tools to engage with existing buildings sensitively while accommodating contemporary programmatic needs. This pedagogical approach aligns closely with the concept of the “reflective practitioner,” as proposed by Donald Schön which advocates for design education that mirrors professional practice through reflection-in-action and reflection-on-action.[15]

Within Mina Zayed, students confront the complexities of existing industrial structures, making evaluative judgments that balance heritage preservation, functional transformation, and socio-spatial impact. By situating projects within the site and aligning them with the Abu Dhabi 2030 vision, the studios immerse students in real-world cultural, economic, and urban conditions. This integration of adaptive reuse, reflective practice, and place-based learning bridges theory and applied design, fostering critical thinking, contextual awareness, and a sense of agency in future architects and interior designers.

Architectural Case Study: The "WE Produce" Ecosystem at ADU

The WE Produce project by architecture student Ayesha Ali at Abu Dhabi University proposes transforming a series of Mina Zayed warehouses into a hybrid ecosystem integrating cultural, agricultural, and social programs, conceived as a physical and conceptual extension of Warehouse

421. Through an incremental reuse strategy, the project reactivates the spatial and structural potential of the existing fabric, reasserting the relevance of industrial warehouses within the urban fabric while establishing conditions for a self-sustaining, community-oriented environment. At the urban scale, the proposal introduces a new angular axis that deliberately disrupts the rigid orthogonal grid of the former port infrastructure. As illustrated in Figure 6, this intervention reflects adaptive reuse strategies that prioritize spatial reconfiguration over extensive replacement, breaking the linearity of the industrial layout to generate public open spaces that function as extensions of interior programs. These outdoor areas act as connective tissue between buildings, enabling social interaction and programmatic overlap while enhancing environmental performance. At the architectural scale, the project explores adaptive reuse through a series of targeted interventions derived directly from the existing conditions and programmatic requirements. These include horizontal and vertical extensions to accommodate new densities and functions, selective subtraction to carve voids within the warehouse mass for daylight penetration and internal *sikkas*, a typical alley in UAE urban form, and façade refurbishment strategies that retain the structural frame while upgrading thermal performance and architectural expression. Together, these moves reflect the principles of "designing to reuse" and "leveraging industrial DNA" discussed earlier, in which new content is carefully adapted to existing containers through minimal yet strategic transformations.

The project's impact and pedagogical effectiveness were further reinforced through its publication on international architecture student platforms and its shortlisting for the Tamayouz Excellence Award for Graduation Projects.[16] These outcomes underscore the value of a studio methodology that combines rigorous contextual and historical research with provocative yet measured contemporary intervention.

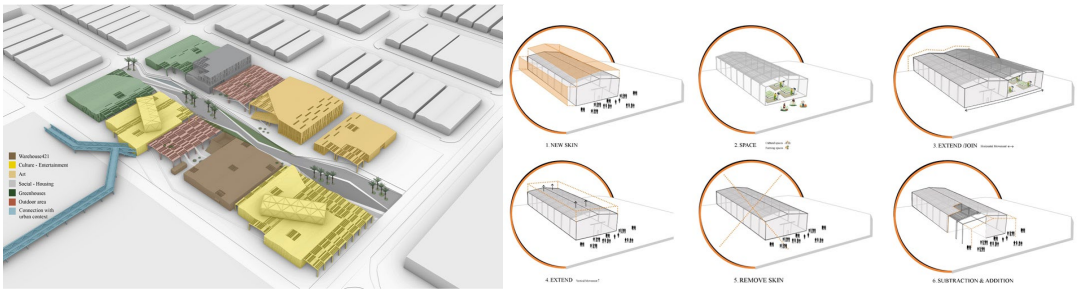


Figure 6. Architectural design strategies and outcome of the research and design project we produced (source: Tamayouz Award 2020).

Interior Design Case Study: The Food Market Dialectic at ZU

While architecture and interior design both aim to create spaces that support human activity, adaptive reuse introduces an added layer of complexity by requiring new spatial arrangements within existing building envelopes, often involving substantial reconfiguration of floor plans, circulation, and environmental strategies. Building on these principles, the Fall 2022/23 interior design studio at Zayed University's CACE challenged students to transform two warehouses adjacent to Warehouse 421 into a public food market and community kitchen, using functional and formal interventions to activate the street frontage, enhance permeability, and strengthen connections to the surrounding urban context. The brief emphasized inclusive, community-oriented environments, positioning interior architecture as a mediator between industrial fabric and contemporary public life, with objectives centered on spatial efficiency, energy mitigation, and low-carbon material strategies. Students developed programs comprising a central market hall, community kitchen, dining areas, workshops, and event spaces, conceived as an interconnected sequence of functions supporting cross-

cultural interaction and communal gathering, reinforcing the idea of functional unity across the building as a coherent spatial whole.

Over the course of the semester-long project, students produced a diverse range of design proposals that addressed the studio's objectives through layered spatial and material strategies. Internally, layout design was closely coordinated with circulation and accessibility planning, clearly distinguishing between public and service entrances while facilitating smooth transitions and user flow. Spatial distribution strategies included the insertion of internal courtyards to introduce daylight and ventilation, horizontal and vertical expansion within the existing envelope, and programmatic stacking to optimize spatial efficiency. These interventions were complemented by horizontal and vertical glazed surfaces, brise-soleil, internal shading canopies, and deep recessed entrances, all of which contributed to environmental performance and spatial legibility.

Material reuse formed a central component of the interior design strategy, with students employing reclaimed shipping containers as modular kitchen and vendor units, corrugated metal sheets referencing industrial heritage, and reclaimed wood and bamboo to introduce warmth and shading. Living plants were integrated as both functional and atmospheric elements, contributing to thermal comfort and spatial identity. Collectively, the projects demonstrate how adaptive reuse can be effectively embedded within interior design education, fostering heritage awareness, sustainability, and social engagement while enabling innovative spatial and material experimentation.

CONCLUSION

The exploration of adaptive reuse within Mina Zayed demonstrates the potential of design education to catalyze sustainable urban transformation. Through studios at Abu Dhabi University and Zayed University, adaptive reuse was positioned not as a technical response to obsolescence but as a critical, culturally grounded design practice. Engaging directly with the site's industrial fabric, students negotiated heritage preservation, environmental responsibility, and contemporary programmatic needs, producing proposals that blend local identity with forward-looking spatial strategies. Interventions such as internal courtyards, reconfigured circulation, activated public edges, and reclaimed materials illustrate how industrial remnants can become vibrant, multifunctional environments that foster communal interaction and cultural continuity.

At a broader scale, the Mina Zayed case underscores the evolving role of higher education within national development agendas. Aligned with the UAE Net Zero 2050 strategy and the academic third mission, the studios functioned as pedagogical laboratories bridging theory and practice, education and industry, and local context and global discourse. Partnerships with professional practices and engagement with real urban processes enabled students to develop evaluative judgment, climate literacy, and socio-spatial awareness. As Abu Dhabi continues to reimagine its post-industrial landscapes, the lessons derived from Mina Zayed affirm the capacity of design studios to shape not only better buildings but more resilient, culturally rich, and socially engaged cities.

NOTES

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[4] Abu Dhabi Urban Planning Council, *Plan Abu Dhabi 2030*.
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[10] Ioannis Vardopoulos, "Industrial Building Adaptive Reuse for Museum: Factors Affecting Visitors' Perceptions of the Sustainable Urban Development Potential," *Building and Environment* 222 (2022): 91–98, https://doi.org/10.1016/j.buildenv.2022.109391.
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[12] Eve Grinstead, “Global Art Market in the Aftermath of COVID-19: A Case Study on the United Arab Emirates,” *Arts* 10, no. 3 (2021): 59, https://doi.org/10.3390/arts10030059.
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DESIGN TO MANUFACTURING: PROCESS RELATIONSHIPS EXPLORED THROUGH HYBRID REPRESENTATION III

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INTRODUCTION

In the fall of 2023, Marywood University ran the third course in a three-course Hybrid Representation sequence, delivered during the foundations program of the BARCH and IARC programs, for the first time. During this course, students translated objects from our physical reality into digital space, transformed them using digital modelling techniques, and then created a physical output using digital fabrication tools and methods. At each stage, students were asked to consider scale and materiality. This paper presents several of the projects and results of this course. Introducing digital fabrication tools to students in their beginning design education helps to make connections between our model making tools and the manufacturing of architecture. With the introduction of digital space as a further abstraction from physical reality[1] in the contemporary design process, it is important that design students have a foundational understanding of both scale and material reality, especially when using digital modeling and fabrication tools.

Course Logic & Assignments

Hybrid Representation III is the third in a three-part representation sequence during the foundational years of the BARCH and IARC programs at Marywood University. From the first day of class, students are asked to consider what hybrid representation means. For example, hybrid could mean to be produced by a combination of two or more distinct elements, or represent a middle ground between a typically dichotomy relationship like light and dark or physical versus digital space. Representation in this course could refer to an artistic likeness or image, the way students convey their design intentions or how we represent concrete and abstract concepts like space and time through various drawing, modeling, and experiential tools. Within the course, students are challenged to first study a physical object, translate it into digital space, manipulate the digital form, and finally arrive again at a physical output through use of digital fabrication technology as illustrated in Figure 1.

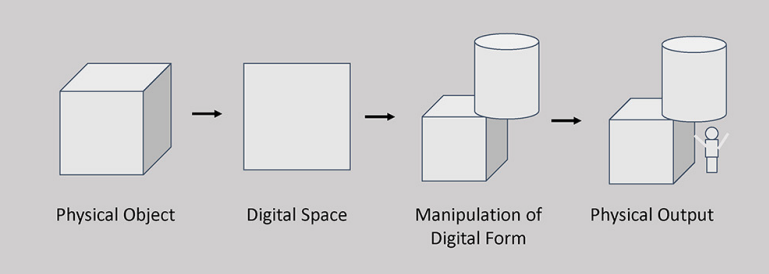


Figure 1. Hybrid Representation III course logic of transformation.

Through four assignments in the semester, this course logic is designed to help students develop their representational skills, observe shifting of scales, work with material reality and the constructability of their design, and instill within them a sense of design agency from design through the final construction process. The four assignments in the course included: A1 Sculpt, A2 Tessellate, A3 Manufacture, and A4 Exhibit. In A1 Sculpt, students were provided with a Richard Serra[2] inspired verb and a basic geometry. They were then challenged to create a physical form derived from this verb and geometry pair. Next, they practiced direct modeling through use of Rhinoceros 3D to replicate their physical object. Finally, they produced a 3D printed model of their transformed object. This is demonstrated by the student work of Joseph Brown who was assigned pairing cylinder to stretch in Figure 2.



Figure 2. Cylinder to stretch by Joseph Brown.

Next, students learned about parametric modeling through the creation of a digital tessellated tile in A2 Tessellate. After digitally creating a negative, the form was CNC routed into foam to create a mold. When the mold was filled with plaster it created the intended tessellated tile. In A3 Manufacture, students were introduced to Autodesk Inventor as an example of parametric and BIM modeling. They used paper models to explore folding which translated digitally into sheet metal folding commands in the software. This assignment culminated with a trip to Boyce Products Ltd. in Damascus, PA where their designs were fabricated during a student tour. In the final assignment of the course, A4 Exhibit, students were further introduced to BIM modeling through Autodesk Revit. They were tasked to create a digital exhibition space to house the outputs from the previous three assignments. This assignment challenged students to consider scale and the relationships of their work to the human form and interior space. Students then rendered views of their exhibit design as exemplified in Figure 3. This paper will expand upon A2 Tesselate and A3 Manufacture.



Figure 3. A4: Exhibit Rendering by Kyle Falcon.

TESSELLATE

A2 Tesselate began with an introduction and analysis of tessellations through examples of M.C. Escher's body of symmetry work from 1937-1967.[3] Tessellations in themselves are significant in architectural geometry design throughout history and have become widely used in modern designs through the use of computer tools.[4] This assignment takes a contemporary spin on the tessellation, allowing students to first make digital tessellations using parametric modeling tools and then capturing an extruded version of the pattern as a low relief tile.

Parametric Modeling

Building upon direct modeling[5] skills in Rhinoceros 3D learned in A1: Sculpt, a warm up exercise prompted for the creation of two dimensionally tessellated 3D forms. These used grids formed of basic shapes that tessellate such as squares, equilateral triangles, and hexagons that tessellate as a starting point. Next, parametric modeling[6] was introduced in the course through use of Grasshopper with Rhinoceros 3D.

In this assignment, scale was introduced through conversations about material limitations. From experimentation with the direct modeled tiles, students were required to create a 3D tessellated tile to completely fill a six inch by six-inch frame. The digital model would be fabricated using a CNC router to cut the negative or mold for these tiles out of one-and-a-half-inch thick foam so they had to be no thinner than half inch and no thicker than one inch. In class demonstrations of Grasshopper coding were paired with example codes. The students spent time experimenting with the example codes and their own explorations to create a tile of their own preference. After the positive tile was created, a final step was needed to translate the positive into a negative mold which could be used for casting plaster. An example of a completed negative tile mold is exemplified by figure 4.

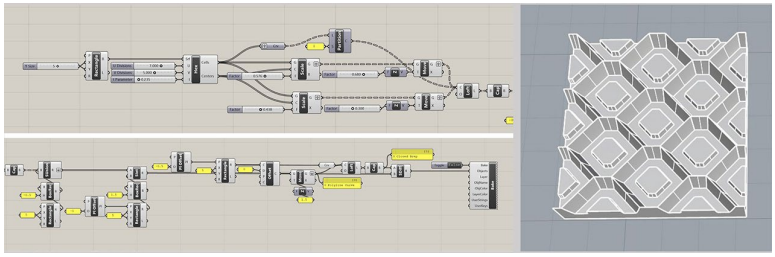


Figure 4. Grasshopper code and resulting tile negative by Nathan Rushia.

Manufacturing Tools – CNC Router

After working in a digital environment, the next steps of the Tessellate assignment were intended to introduce CNC routing as a subtractive manufacturing method.[7] This digital fabrication method demonstrated the complexities introduced through scale and material properties from digital to physical environments. A CNC router uses a rotating milling bit to carve away material resulting in the final form. The 3D tile negatives were programmed and the router bit was then controlled to create the negative shape in a piece of one-and-a-half-inch thick XPS foam. Following the milling of the molds they were treated with a release agent and filled with plaster. Once removed, this resulted in the final plaster tiles as shown in figure 5.

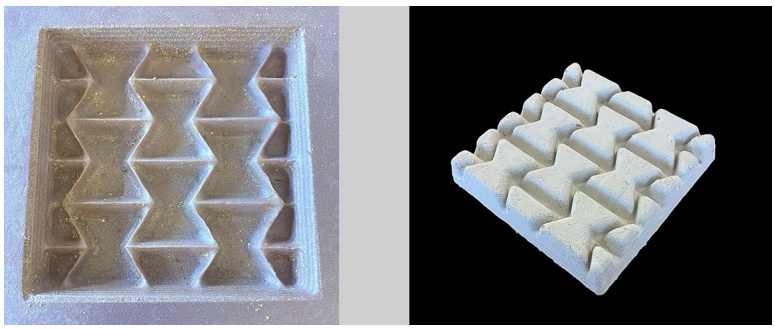


Figure 5. CNC milled negative mold and resulting plaster tile by Annabel Adams.

Tesselate Outcomes

Throughout this assignment students were given the opportunity to use parametric modeling, more specifically Grasshopper coding, to create a digital tessellated tile and a resulting derived physical plaster tile. In the digital realm, there were challenges with completing the grasshopper code as this was an initial introduction to the software. However, once students were more comfortable with the software, they were able to successfully produce the negative geometry required for the mold.

This assignment was particularly useful in introducing CNC routing as a method of digital fabrication widely used in architectural model making and full fabrication. In addition, it also demonstrated considerations of scale and materiality through physical production that are not inherently apparent in digital modeling. For example, this project was ultimately a mold making assignment. When modeling the tiles, students largely made use of lofted commands and geometries to ensure that they did not create any undercuts. Undercuts in the geometry would have prevented the hardened plaster from being able to be removed from the mold. In addition, the digital environment, though scaled, can be experienced at many levels of detail and zoom. In their creation, some tiles contained very intricate details. However, when the tiles were milled using the CNC router, the students learned that the amount of detail that was able to be carved was directly related to the diameter of the ball nose endmill used to remove the material. Therefore, details under a quarter of an inch were expanded and rounded out to accommodate the width of a quarter of an inch tool bit. A resulting collection of tiles from the course can be seen in figure 6.



Figure 6. Tessellated plaster tiles.

MANUFACTURE

A3: Manufacture was introduced as a deeper conversation of how Architectural and Interior Architectural elements were processed from digital designs to physical realities. Boyce Products Ltd.[8] located in Damascus, PA was used as an example. Boyce Products is a custom Architectural Fabricator with over 30 years of experience and capabilities including woodworking, metalworking, automation, electrical, and finishing. Successful design and creation of custom architectural elements begins with the designer's ability to understand material limitations, scale, and communicate design intentions.

Within this context, the students were introduced to a process called air bending.[9] This sheet metal process has revolutionized the way in which custom concepts are able to be designed digitally using parametric and BIM modeling software and then fabricated without the use of an abundance of customized tooling. After a digital sheet metal part is imported into the software, it is digitally flattened and programmed as a flat pattern to be cut by a fiber laser. Then, a large computer-controlled brake forms the sheet metal with precisely calculated pressure.

The students were asked to explore sheet metal folding first as folded paper models. This served as a tactile way to explore the bent forms. Throughout A3: Manufacture, this allowed for the consideration of how the bent form would change as materiality changed from paper, to digital space, and then to a folded sheet metal model.

Parametric/BIM Modeling

Autodesk Inventor was utilized as both a parametric and BIM modeling software because of its ability to simulate folding sheet material in digital space. In addition, this software can record and account for material properties such as the weight of the material and the way it would deform and stretch when bent. As the students began to translate their folded paper models into digital space, they already needed to respond to the constraints of metal as opposed to paper. For example, while the thickness and material strength of the paper allowed for very thin creases, once they began working digitally with 18-gauge sheet metal, it became apparent that the corners could not be bent as tightly as shown in figure 7.

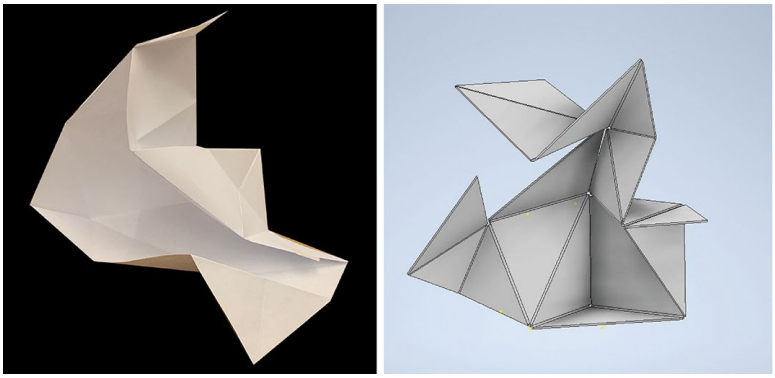


Figure 7. Folded paper model (left) and resulting modifications in digital space (right) by Jocelyn Behan.

Once the students had produced the digital folded sheet metal model of their work, they needed to create a flat pattern and prepare it for bending by hand through use of perforations. The flat pattern was created in Autodesk Inventor and then exported to Autodesk AutoCAD. Annotations needed to be cleaned and line geometry representing cuts was joined as shown in figure 8. Though these .dxf files were double checked by the fiber laser operator, the students laid the groundwork for their designs to be programmed and fabricated. This skill would serve them as a technique for model making using laser cutters for cardboard and chipboard but also parallels a process used in industry at the scale of a building construction element.

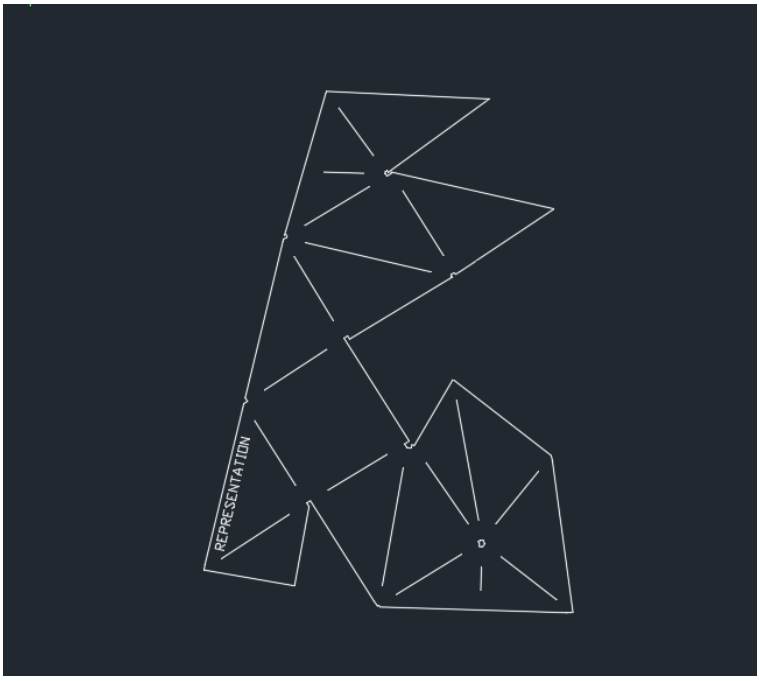


Figure 8. Flat pattern .dxf file showing perforation locations by Jocelyn Behan.

Manufacturing – Fiber Laser

The culminating experience for A3 Manufacture occurred on site at Boyce Products manufacturing campus in Damascus, PA. Following a tour of the facility where students saw pieces of custom architectural elements being manufactured and assembled, their designs were cut out using a Trumpf fiber laser.[10] This machine uses a laser and a shield gas to cut shapes out of sheet metal in the same

way that a desktop laser cutter could cut through cardboard or chip board for a model. On this tour, the students were able to make connections between the models they make in school and the manufacturing processes that they will interact with in their future careers. For efficiency, the student models were nested and cut out of two sheets of material in one program as shown in figure 9.



Figure 9. Trumpf fiber laser cut out each of the students work nested on two sheets of material.

Manufacture - Outcomes

Through this assignment the students learned about the use of parametric modeling tools that consider material properties. They also learned about the iterative and prototyping process through evolving their folded models in response to changing conditions. First, they began with paper models, then under the constraints of the material thickness the design changed. Finally, when the final piece was cut from sheet metal, they had the opportunity to fold their model using the pressure of their fingers along the perforations they created. In some cases, they were able to achieve the intended result based on their digital model, however, other parts of the geometry were more challenging. This final step also allowed them to tune their designs by observing it again in the physical world and adjusting the angle of each bend as shown in figure 10.

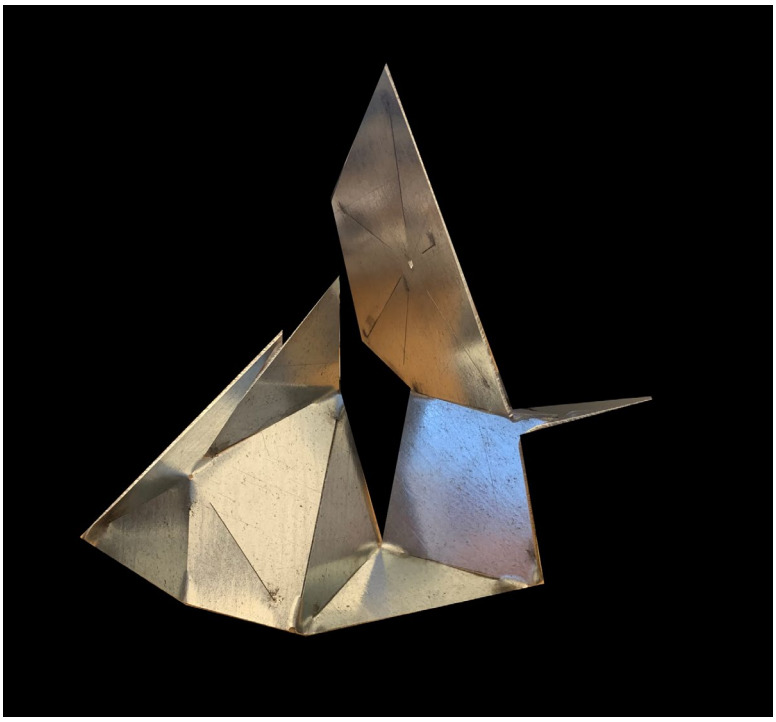


Figure 10. Final folded sheet metal model by Jocelyn Behan.

Overall the field trip to Boyce Products encouraged students to reflect on the consequences, both positive and negative, that their actions will have as designers. Every click of their mouse will have a physical result, will have weight, will have to be fabricated, and will have to be assembled in some way. Architectural manufacturing, and the people tasked with the manufacturing, are just as important to the success of the design as the initial concept. This tour helped students to appreciate the effort that goes into architectural manufacturing.

CONCLUSION

Throughout this course and continued offerings in the fall of 2024, 2025, and 2026, the author has noticed that student engagement is higher when hands on activities are mixed with lectures and digital environments. Student comments from the course support this and furthermore have appreciated the tour of Boyce Products as a manufacturing facility. Both assignment A2 Tessellate and A3 Manufacture allowed students to make connections between the fabrication tools utilized in a learning environment for modeling and their application to real world architectural construction. In addition, having the practical experience of making something themselves and touring manufacturing facilities help students understand that each click of their mouse or stroke of their pencil has consequences both wonderful and challenging.

With the introduction of digital space in the contemporary design process it is important that design students have a foundational understanding of both scale and material reality, especially when using digital modeling and fabrication tools. This course was structured so that students would get to learn about contemporary digital modeling software and companion digital fabrication equipment in parallel. The work flow presented which takes a physical object, translates it into digital space for modification and then outputs it back into physical reality through use of digital fabrication equipment is one that students will continue to use throughout their careers. These skills can be understood as more than just a representational or communication tool. They are directly parallel to the building construction process and the generation and fabrication of new forms and new ways of working with materials. Though design and modeling in Architecture and Interior Architecture is now accomplished digitally, the final product will be created in physical space out of real material, and will be utilized by humans. While our digital environment can be considered to be scale less, it is important that students are always reminded of scale and materiality.

NOTES

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TAPIRITECH: A PARTICIPATORY PLATFORM FOR TEACHING ECOSYSTEMIC DEMOCRACY

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INTRODUCTION

Navigating Petare for the first time revealed the complexity of its spatial logic. As one of the most densely populated self-produced urban environments in Latin America, Petare is often framed through the reductive lens of the "informal settlement." Yet its spatial configuration did not emerge from an absolute absence of planning, but from the cumulative, piecemeal interventions of thousands of residents, whose everyday decisions and practices have produced a coherent—though non-codified—urban order.

Encounters with Petare's community-members helped clarify two insights that later informed the development of TapiriTech. First, spatial knowledge is always situated, emerging from embodied, partial, and accountable perspectives.[1] Second, territories like Petare are contested, shaped by overlapping claims, exclusions, and negotiations, and cannot be reduced to a single normative representation that imposes dominant logics upon underrepresented groups. Conventional planning pedagogy often frames territory as an abstract object, legible primarily through technical maps and simulations intended for expert audiences. In doing so, it risks marginalizing lived experience, Indigenous knowledge systems, and forms of ecological agency that include more-than-human actors within planning processes.

TapiriTech was developed as a pedagogical response to this gap. The name is derived from the Yek'wana concept of the tapiri, a communal structure designed for gathering, deliberation, and relational living among human and more-than-human kin. The invocation of this term acknowledges Indigenous relational worldviews that regard space, decision-making, and ecology as inseparable. TapiriTech draws from this ethos to reimagine the design studio as a space of encounter, care, and collective world-making, while remaining respectful of Yek'wana knowledge traditions. Rather than treating design students as problem-solvers acting upon inert sites, TapiriTech invites them to democratically co-design with ecosystems. It emphasizes visibility of flows of water, wildlife, ancestral paths, policies, and multispecies narratives that are typically excluded from conventional representations. By transforming abstract territorial concepts into a tactile, shared learning surface—a "pedagogical table"—TapiriTech redefines design education as a practice of listening, negotiation, and care.

DEFINING ECOSYSTEMIC DEMOCRACY

Ecosystemic democracy expands the concept of democratic participation to include ecosystems, non-human beings, and socio-ecological systems as active agents in territorial decision-making. Framed within a political ecology perspective, it challenges the portrayal of nature as a passive backdrop and instead understands territory as a dynamic field of ecological and social interrelations.

In current planning discourse, ecosystemic democracy arises in response to the limitations of anthropocentric governance models that prioritize human interests while externalizing ecological consequences. Conventional democratic processes often acknowledge only human actors as legitimate political participants, relegating forests, rivers, animals, and climate systems to the status of resources or constraints. Ecosystemic democracy challenges this division by emphasizing that these entities already shape territorial outcomes—through floods, droughts, species migration, soil degradation, and regeneration—and thus demand political consideration within decision-making processes. This expanded view of responsibility aligns democratic practice with structural justice, focusing on collective accountability for indirect, distributed ecological impacts.[2]

Ontologically, ecosystemic democracy builds on a critique of human exceptionalism, challenging the assumption that meaning-making, interpretation, and political relevance belong exclusively to humans. Scholars across anthropology, environmental humanities, and political ecology argue that meaning-making, interpretation, and responsiveness are not exclusive to humans. For instance, Eduardo Kohn describes how forests express agency and communicate through semiotic processes.[3] In Sierra de Carapé, Uruguay, residents describe this phenomenon by saying that “la sierra habla” (the mountain speaks). Over time, the mountain is perceived as responding to human activity by altering its ecosystemic relations.

This ontological shift aligns with Indigenous and relational worldviews in which mountains, rivers, and territories are not objects but participants in ethical and political life. Eduardo Viveiros de Castro’s theory of Amerindian perspectivism asserts that the world is inhabited by different kinds of subjects or persons, human and non-human, thereby affirming the agency of non-human beings.[4] While the explicit inclusion of non-humans in planning and design may appear overly optimistic within conventional professional frameworks, it is often experienced as self-evident by Indigenous collaborators, who in participatory settings consistently emphasize the need to account for keystone species’ migration patterns, watercourse dynamics, and other ecological processes within decision-making. Rather than translating such beings into modern environmental categories, this approach calls for practices that engage ontological difference as irreducible.[5] These practices enable negotiation across partially incommensurable worlds, embracing context-specific autonomy rather than universalized solutions.[6] From an institutional perspective, ecosystemic democracy critiques the technocratic framing of environmental decision-making. Modern governance and planning often treats ecological concerns as matters of expert intervention, thereby obscuring normative decisions as technical necessities.

For instance, the deployment of wind turbines—often promoted as universally sustainable solutions within technocratic planning frameworks—has revealed significant ecological trade-offs, including documented disruptions to bird migration patterns.[7] Such cases illustrate how decisions framed as purely technical can sideline ethical and ecological considerations that require broader democratic deliberation. This requires broadening the scope of political representation and developing participatory protocols, tools, and pedagogies capable of mediating between human and non-human interests.[8] In this context, design can function as a form of ecological diplomacy, relying on the capacity—and willingness—of human actors to represent more-than-human concerns within participatory planning processes.

Crucially, ecosystemic democracy is not a static model but a situated practice. As Donna Haraway argues, knowledge and action are produced within specific spatial and relational contexts.[9] Geospatial design thus plays a vital role in cultivating a more inclusive, ecological democracy. Because knowledge of ecosystems is partial, embodied, and accountable, no single map or dataset can claim a total perspective. Democratic engagement depends on the negotiation of situated perspectives and on cultivating ethical relations across difference. Relational ethics—based on care, response-ability, and co-becoming—foreground interdependence and vulnerability, challenging ideals of detached control.[10] In both descriptive and normative terms, ecosystemic democracy acknowledges the agency of human and non-human actors in shaping territory, while calling for pedagogical and design practices that engage those interdependencies with ethical rigor. TapiriTech brings these principles into a pedagogical framework that treats democracy not as a procedure, but as an ecological practice

THE AGENCY OF MAPS

Maps occupy a paradoxical role in planning and design education. While they serve as essential tools for analysis and coordination, they often obscure the very relationships they seek to represent. James Corner's influential essay "The Agency of Mapping" challenges the notion of maps as neutral instruments. According to Corner, maps are projective devices that construct spatial possibilities rather than merely reflect existing conditions.[11]

Mark Monmonier, in his book *How to Lie with Maps*, takes a more skeptical stance. He shows how all maps distort reality through selective choices of scale, projection, classification, and symbolism. These distortions, although not always intentional, have profound effects. Maps persuade; they naturalize particular perspectives while marginalizing others.[12] Together, Corner and Monmonier reveal mapping as a dual practice: both generative and dangerous, capable of opening or closing future possibilities. Within this research, maps are treated not only as tools of representation, but as narrative mechanisms capable of introducing more-than-human actors into design processes.

TapiriTech operates deliberately within this tension. It seeks to acknowledge Monmonier's critique that no map is neutral, while embracing Corner's vision of mapping as a generative act. The platform reframes mapping as a dialogical process rather than a conclusive product. Maps generated through TapiriTech are provisional artifacts meant to prompt discussion, invite critique, and evolve through iteration.

TapiriTech begins with CNC-milled terrain (computer numerical control milling) models of a given site, onto which dynamic video projections are layered to visualize interactions among multiple stakeholders. These projections allow participants to explore ecological processes such as water flows and bird migration, as well as human activities including circulation patterns and economic transactions—where they occur and how they shape ecological systems. By animating these interactions directly on the physical model of the landscape, the platform facilitates dialogic engagement among scholars, community members, and other stakeholders. This shared visual environment supports critical discussion about why such phenomena occur and how design interventions may align with—or come into tension with—existing ecological and social relations.

Donna Haraway's concept of situated knowledges offers a useful lens through which to interpret the mapping practices enabled by TapiriTech. The maps produced through the platform are deliberately partial, making visible certain perspectives while inevitably leaving others absent. Rather than presenting these representations as comprehensive or definitive, the process invites participants to reflect on questions such as "Accurate for whom?" and "For what purpose?" In this way, TapiriTech does not seek totalizing precision, but explores relational legibility as a provisional and dialogic mode of spatial inquiry.

PETARE: THE PILOT

TapiriTech was first tested as a pilot project in Petare, Caracas—one of Latin America's largest self-produced urban environments. Characterized by steep topography, self-produced construction, limited infrastructure, and strong social networks, Petare presents a highly complex and contested territory where conventional planning tools often fail to capture lived spatial realities. The pilot emerged from collaborations with local residents, students, and community leaders, and it focused on understanding how ecological processes intersect with everyday practices in conditions of structural inequality.

In Petare, TapiriTech was used to co-design blue and green infrastructure strategies aimed at increasing spatial opportunities in vulnerable barrios. CNC-milled terrain models represented the steep hillsides and drainage basins that shape daily life, while projected layers visualized water flows, landslide risks, self-produced paths, and community-defined landmarks. Rather than imposing predefined solutions, the platform allowed residents to narrate how rainwater moves through the neighborhood, where flooding occurs, and how informal circulation networks respond to topography.

Informal shortcuts, social nodes, and ecological thresholds—often invisible in official maps—became central elements of the collective analysis. This interaction reinforced the idea that maps are not neutral representations but negotiated artifacts shaped by power, memory, and practice.

Pedagogically, the Petare pilot exposed students to the limits of technocratic planning and the necessity of situated knowledge. It demonstrated how ecological agency manifests through lived experience—through water that erodes paths, vegetation that stabilizes slopes, and collective practices that adapt to risk. These lessons directly informed the later development of the N'dakinna workshop, particularly the emphasis on storytelling, relational mapping, and the inclusion of non-human actors as active participants in design.

N'DAKINNA: THE WORKSHOP AS PEDAGOGICAL PRACTICE

The most developed pedagogical application of TapiriTech to date took place at the University of New Hampshire, Durham campus, on ancestral Abenaki land known as N'dakinna. Implemented within a design studio focused on Indigenous stewardship and campus planning, the workshop titled Designing Ecological Narratives: From Mapping to Kin-Making served as a practical exploration of ecosystemic democracy through spatial storytelling.

The workshop unfolded through five carefully structured steps: (1) Stories That Happen in Space, (2) Mapping the Actors, (3) Designing the Narrative Ecology, (4) Design as Ecological Diplomacy, and (5) Composing the Story Sequence. Together, these steps guided students from recognizing space as a lived and contested field of relations, through identifying actors and their interactions, toward the construction of time-based spatial narratives that render ecosystemic democracy visible and debatable. The workshop's goal was to develop a diagram organizing a legible system of relationships among these actors (see Figure 1), which could later be mapped and video-projected through TapiriTech.

Step 1: Stories That Happen in Space

The workshop began with a collective discussion that reframed the UNH Durham campus—referred to by its Abenaki name, D'Namika—not as a neutral site but as a territory saturated with ongoing stories. Students were invited to reflect on how daily practices, ecological processes, and institutional histories overlap spatially. Humans, non-humans, and non-physical systems were introduced as co-present participants in shaping space. A concrete example of the tensions produced by these relations emerged around College Brook, where non-human agents—the forest and its associated ecosystem—exist within the academic campus and simultaneously attract human activities such as walking, informal gatherings, and outdoor study. While these practices are often motivated by an appreciation

of ecological qualities, they can become sources of ecological pressure if not approached with care and respect, illustrating the fragile negotiations that characterize shared human–non-human territories. This initial step shifted perception from space as a static container to space as a living network of interactions. By foregrounding narrative and experience, students began to recognize the campus as a contested and relational territory rather than a fixed design problem.

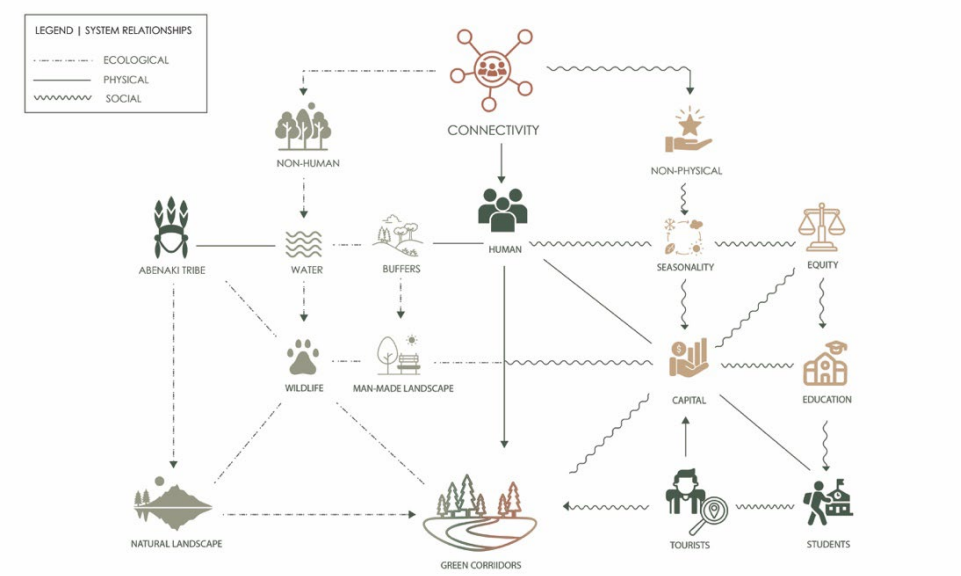


Figure 1. Systems of Relationships. Students: Andressa Dias Gomes, Maria Noguera, Samiha Waheed. Instructors: Ignacio Cardona, Karen Mata, and Rodrigo Guerra

Step 2: Mapping the Actors

In the second step, students identified a broad and inclusive range of actors involved in their selected areas of campus. These included human actors (students, staff, planners), non-human actors (trees, wildlife, water, soil), and non-physical systems (policy, capital, governance, energy flows). Actors were represented using icons, keywords, sketches, and diagrams.

This exercise expanded the definition of participation by making visible entities typically excluded from planning processes. Mapping actors in this way challenged students to confront the limits of anthropocentric design and to acknowledge distributed agency across ecological and institutional systems.

Step 3: Designing the Narrative Ecology

The third step focused on relationships rather than entities. Students connected actors using verbs—such as “feeds,” “shades,” “blocks,” “regulates,” or “excludes”—to describe how interactions unfold over time. Directional arrows and layered connections transformed static diagrams into dynamic relational ecologies.

By privileging verbs over nouns, this step emphasized processes, feedback loops, and transformations. Students began to see how spatial decisions produce cascading effects across social and ecological systems, revealing sites of tension, vulnerability, and opportunity.

Step 4: Design as Ecological Diplomacy

In the fourth step, students presented their relational maps in a collective critique framed explicitly as ecological diplomacy. Rather than defending formal solutions, students were asked to articulate negotiations between competing actors and interests. Discussions centered on questions such as: What happens when one actor's flourishing undermines another's? Who mediates between ecological needs and institutional priorities?

Step 5: Composing the Story Sequence

The final step translated relational diagrams into temporal narratives by foregrounding questions of sequence and causality: What happens first, and which relations give rise to others? Students developed storyboards that guided digital projections onto CNC-milled terrain models, using time-based representation to explore how interactions unfold. These projections animated ecological and social processes over time—such as wildlife paths intersecting with infrastructure, water flows responding to seasonal change, and policies reshaping patterns of movement.

The resulting video-projections functioned as spatial stories rather than data visualizations (See Figure 2). They rendered coexistence, friction, and transformation legible, allowing participants to experience territory as an unfolding process rather than a static plan.



Figure 1. TapiriTech in Action. Students: Damien Josephson, Giovanny Delina, and Jamie Tam. Instructors: Ignacio Cardona, Karen Mata, and Rodrigo Guerra of Relationships.

Pedagogy of Ecosystemic Democracy and Relational Design

From a pedagogical perspective, the workshop achieved several learning outcomes. Students developed the ability to identify and represent human, non-human, and systemic actors; to visualize relationships rather than isolated objects; and to articulate design as a form of negotiation rather than control. The use of storytelling and video-projection fostered temporal thinking, ethical reflection, and collaborative sense-making, expanding students' understanding of what constitutes design knowledge and where, spatially and relationally, it is produced.

Donna Haraway's theoretical contributions were not simply referenced but operationalized throughout the workshop. Situated knowledges framed the recognition that every map is partial and accountable.

Her emphasis on response-ability and making kin informed the ethical orientation of the narratives, encouraging students to approach design as an ongoing practice of relating to others—human and non-human—within shared but unequal worlds. In this sense, the workshop transformed ecosystemic democracy from a theoretical construct into an embodied pedagogical practice.

CONCLUSIONS

TapiriTech proposes a shift in design pedagogy—one that remains open to further exploration—from representation to relation, from problem-solving to negotiation, and from mastery to care. Rather than positioning maps as authoritative endpoints, TapiriTech approaches them as shared surfaces for inquiry, making visible the ethical and political dimensions of spatial decision-making.

Revisiting the question of mapping after the N'dakinna workshop clarifies that the agency of maps does not reside solely in their capacity to represent space, but in their ability to convene relationships. As theorized by James Corner, maps are projective instruments capable of generating new spatial imaginaries[13]. The workshop demonstrated that this projective capacity becomes pedagogically potent when maps are treated as provisional, narrative, and open to negotiation. In this sense, TapiriTech does not reject maps; it reclaims them as instruments of ecological diplomacy—devices that prompt dialogue about which relations a territory sustains, which it suppresses, and who bears responsibility for those outcomes.

Seen through the lens of the workshop, Monmonier's warning about the persuasive power of maps gains renewed relevance.[14] By externalizing representational choices—what actors to include, which relations to emphasize, how to sequence narratives—onto a shared, tangible surface, TapiriTech transformed potential distortions into topics of collective reflection. Cartographic agency thus shifted from an expert prerogative to a shared responsibility, aligning mapping practice with the principles of ecosystemic democracy. At the same time, this approach does not presume neutrality or consensus: participatory processes remain shaped by biases, power asymmetries, and the degree of honesty and willingness with which participants engage in collective inquiry.

The experiences in Petare and N'dakinna suggest that mapping can function as a tool for reciprocal learning when it is situated, dialogic, and relational. In an era of climate crisis and deepening social inequity, design education must grapple with more-than-human realities. TapiriTech proposes one possible contribution to this effort by translating theoretical insights from Haraway, Latour, Kohn, and others into concrete pedagogical practices. It suggests that the future of design lies not in producing better representations of the world, but in cultivating better relationships within it.

While this research is limited by its scale and academic context, it points toward future work that extends ecosystemic storytelling into longer-term community and institutional settings. Such efforts may further test how participatory mapping can support sustained ecological negotiation without losing its critical and relational orientation.

NOTES

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REAL-WORLD ARCHITECTURAL PROJECTS

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INTRODUCTION

The *Real-World Architectural Projects* model emerges from a desire to bridge architectural education and civic practice, aligning academic inquiry with the social, environmental, and ethical dimensions of real urban development. Conducted within the Master of Architecture program at California Baptist University (CBU), a fifth-year Design Studio was organized to fulfill its curricular objectives while collaborating with the City of Riverside, including a City Councilmember and city urban planners, to envision a Green Urban Village consistent with Riverside's 2050 General Plan. This collaboration transformed the studio into a platform for civic dialogue, where design became a form of public engagement and applied research.

Institutional and Mission Context

The *Real-World Architectural Projects* model aligns with California Baptist University's mission to cultivate professional excellence within a Christian worldview. By engaging students with civic partners, the project supports experiential learning, community engagement, and faith-integrated education, transforming coursework into a platform for public service and cultural stewardship.

Pedagogically, the initiative advances the CBU Strategic Plan goals of innovation, interdisciplinary collaboration, and leadership development.[1] Through project-based learning, students address real urban challenges while developing critical thinking, collaboration, and ethical judgment. In fostering civic awareness, the project also supports the University's commitment to "engaging culture and transforming communities," shaping architectural education as a practice of stewardship and service. The project further integrates faith and practice by encouraging reflection on how architecture can embody care, beauty, and sustainability, contributing to the flourishing of both people and place.

Learning by Doing and Project-Based Learning (PBL)

The *Real-World Architectural Projects* embodies the Renaissance ideal of learning by doing, a pedagogical principle rooted in the studios and workshops of master builders, artists, and humanists. As Leonardo da Vinci observed, "experience never errs; it is only your judgments that err in promising themselves effects such as are not caused by your experiments,"[2] expressing the Renaissance conviction that true knowledge arises through observation, making, testing, and direct engagement with the world. This intellectual foundation underlies studio-based learning, craft traditions, and experiential pedagogy across disciplines. Just as apprentices in the Renaissance learned through direct engagement in real commissions (observing, experimenting, and refining their craft under the guidance of mentors) students in this project learn architecture through authentic design

practice tied to the civic life of the City of Riverside. By confronting real urban constraints, client feedback, and environmental considerations, students internalize architectural knowledge not as abstract theory but as applied wisdom. This experiential approach transforms the classroom into a contemporary atelier, where reflection and making are inseparable acts of learning. In this way, the project revives a timeless educational lineage, connecting CBU's architectural pedagogy to the Renaissance model that united craft, intellect, and moral purpose in the pursuit of meaningful work serving both beauty and community.

This historical path finds its contemporary pedagogical counterpart in Project-Based Learning (PBL), and the *Real-World Architectural Projects* model deliberately unites both traditions within a single framework. PBL structures learning around real-world questions, extended inquiry, and public outcomes. As Blumenfeld et al. explain, project-based learning engages students in sustained investigation, problem-solving, communication, and reflection as central mechanisms of knowledge construction.[3] This epistemological structure closely mirrors architectural practice itself: inquiry, iteration, critique, synthesis, and communication.

The effectiveness of this approach is further supported by Donald Schön's theory of reflective practice, foundational to studio-based design education affirming that in the design studio, students learn by doing, by trying things out, by making mistakes, and by reflecting on what they have done.[4] Schön's work clarifies why experiential, project-centered environments are especially suited to architecture, where knowledge emerges through action and critical reflection rather than abstraction alone, positioning students as active participants in solving complex, authentic problems.

This approach is also aligned with Kenneth Frampton's assertion that the fundamental task of architectural education is to cultivate a critical culture that can mediate between the forces of production and the values of society,[5] a principle that underpins the project's ethical and civic orientation. Rather than learning architectural concepts in isolation, students engage directly with a real urban context—the City of Riverside's 2050 General Plan—through the design of a Green Urban Village. This structure transforms learning into a dynamic process of inquiry, collaboration, and application, where students synthesize theory, technical knowledge, and civic awareness to generate tangible design proposals.

Pedagogically, this approach situates the project not only within Project-Based Learning but also within the broader humanistic tradition of experiential education. Through this structure, students are challenged to integrate environmental stewardship, urban policy, and community identity into their design process. The project thus operates simultaneously as an educational experiment, a professional exercise, and a civic partnership. Ultimately, it exemplifies PBL's central aim: to cultivate critical thinkers and responsible practitioners capable of translating academic knowledge into real-world impact, while fostering civic engagement, environmental awareness, and a deeper sense of purpose in architectural education.

The Academy-Government Connection

The *Real-World Architectural Projects* operates as a situated model of collaboration between the academy and governmental institutions, demonstrating how architectural pedagogy can actively participate in civic innovation and public policy formation. As Ernest L. Boyer argues, "the academy must become a more vigorous partner" in addressing society's most pressing social and civic challenges,[6] in the search for answers to our most pressing social, civic, economic, and moral problems, a position that frames the project's underlying standpoint. Through sustained engagement with the City of Riverside, including the participation of Ward 3 Councilmember and city planning staff, the studio establishes a reciprocal interface between academic inquiry and the planning frameworks articulated in the Riverside 2050 General Plan.

This pedagogical structure enables students to address real civic conditions, such as housing equity, environmental performance, and urban regeneration, while positioning the university as an active civic actor rather than a detached observer. The studio thus functions as a critical civic laboratory in which architectural knowledge is tested against public realities, generating both speculative and applicable contributions to contemporary urban discourse.

Through this collaboration, the *Real-World Architectural Projects* strengthens California Baptist University's identity as a civically engaged institution by embedding the design studio within an active city-planning context. The initiative bridges academic inquiry and civic service, enabling students to contribute design proposals that support sustainable urbanism and inform local policy. In doing so, the project enhances the university's public relevance and models how higher education can foster leadership, stewardship, and community impact through meaningful civic partnership. It also models how Christian higher education can extend beyond the classroom, fostering leadership, stewardship, and community transformation through architectural design and civic partnership.

The academy-government connection further reframes the design studio as a site of civic pedagogy, positioning architectural education as an engaged public practice rather than a detached academic exercise. In line with Ernest Boyer's call for a more socially responsive academy,[7] the project situates learning within real institutional and political contexts. Drawing on Henry A. Giroux's conception of education as a form of public and civic practice,[8] alongside Gert Biesta's understanding of education as a relational and ethical encounter grounded in responsibility to others,[9] and Donald Schön's theory of reflective practice,[10] the studio operates as a space of reciprocal knowledge production between students, educators, and civic stakeholders. Through sustained collaboration with the City of Riverside, student work is aligned with the policy frameworks of the Riverside 2050 General Plan and tested against authentic urban conditions. The studio thus functions as a living civic laboratory, where theory and practice converge and architectural education becomes an instrument of public scholarship.

Additionally, by embedding students in sustained collaboration with city officials and planners, this pedagogical strategy constructs a situated learning environment in which professional formation emerges through lived engagement rather than abstract simulation. As Leon Battista Alberti asserted, all these matters must be learned by study and by practice, one of the clearest Renaissance affirmations of the reciprocity between intellectual formation and professional action.[11] This pedagogical stance resonates with Gert Biesta's argument that education should not be reduced to preparation for future outcomes, but should concern the formation of the person in the present, framing learning as an active, experiential, and socially embedded process rather than a deferred outcome.[12] It is further reinforced by Biesta's proposal that education should not be understood as preparation for future outcomes, but as a present, transformative process of subject formation grounded in ethical responsibility and engagement with others[13] and by Etienne Wenger's assertion that "learning is not something we do when we stop living; learning is an integral part of our everyday lives," emphasizing that learning is embedded in participation rather than separated from lived experience.[14]

This academy-government connection aligns also with Ernest L. Boyer's already cited call that the academy must become a more vigorous partner in the work of the professions,[15] and with what Boyer and Mitgang argue, "architecture education must reconnect with the larger purposes of society," positioning the academy as an active participant in civic life.[16] Within this framework, students encountered the real conditions of practice (negotiation, regulation, ethics, and public accountability) developing both technical competence and critical awareness. The project thus functioned as a form of civic apprenticeship, cultivating reflective practitioners who understand architecture as a situated cultural and ethical practice aligned with public purpose**.**

Course Overview ARC510-B Design Studio VII

Cities have increasingly expanded at the expense of rural land, replacing green areas with impermeable "gray" surfaces. Two strategies have proven effective in counteracting this trend: the re-densification of inner urban areas through mixed-use development and the systematic replacement of gray infrastructure with green systems. Within this context, the City of Riverside Comprehensive Master Plan seeks to "alleviate parkland shortage…in a cost-effective manner to enhance the living environment for all residents," while envisioning the Magnolia Avenue–Market Street corridor—historically the backbone of the city's street network—as a restored, landscaped, multi-functional urban spine revitalized through mixed-use and green development.[17] Accordingly, this studio project proposes a mid-rise Green Urban Village featuring housing, co-working spaces, retail, community amenities, patios, gardens, and urban agriculture. The proposal seeks to promote walkability, social interaction, and ecological performance through architectural and urban design strategies.

From a Christian perspective, the contemporary urban village may be understood as a community embodying the values of love, justice, hospitality, and stewardship, reflecting biblical principles of relational life and care for creation. Scripture frames this responsibility clearly: "The Lord God took the man and put him in the garden of Eden to work it and keep it."[18] Likewise, the prophetic vision of a flourishing community is expressed in Isaiah: "They shall build houses and inhabit them; they shall plant vineyards and eat their fruit."[19] The communal life of the early Church, described in the Book of Acts, where believers shared resources, supported one another, and gathered regularly, offers an additional model for social sustainability rooted in shared life and mutual responsibility.[20]

The project also draws conceptually from the nineteenth- and twentieth-century urban theories of the Garden City and the Radiant City, seeking to reinterpret their aspirations for contemporary conditions.[21] Sustainable strategies such as green roofs, green walls, photovoltaic systems, passive design, and urban farms will be integrated as both environmental and pedagogical components.

This work aligns with the missions of both California Baptist University and the City of Riverside 2050 Vision, each of which affirms sustainability as a civic and institutional priority. CBU supports sustainability through academic initiatives, institutional committees, and community engagement, while the City of Riverside advances environmental responsibility through initiatives such as the Climate Action and Adaptation Plan (CAAP), the Waste-to-Energy Project, and the Northside Agricultural Innovation Center (NAIC).[22]

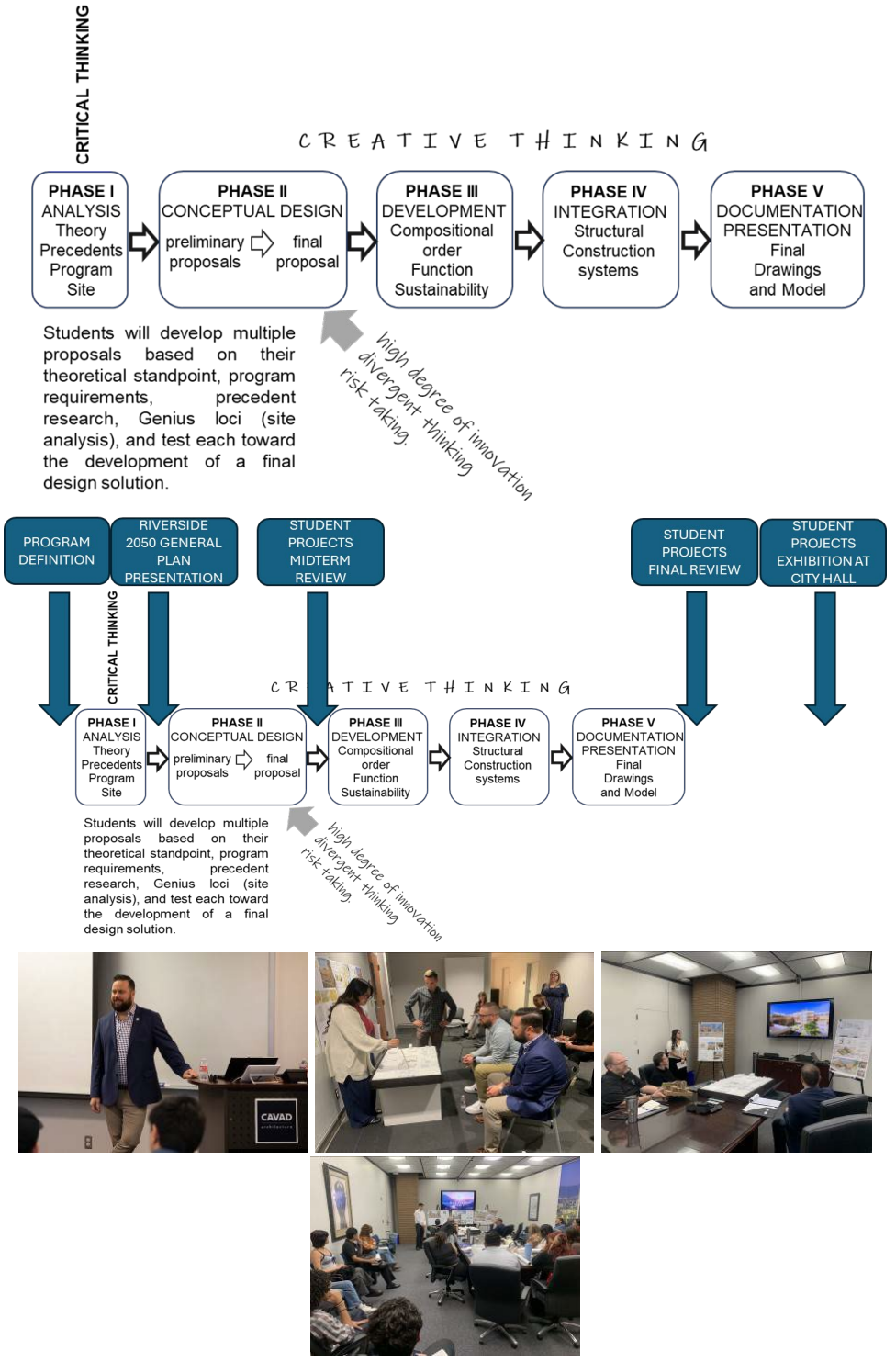
By the end of the semester, students are expected to produce portfolio-quality work. The project site is located in downtown Riverside, at the intersection of First Street and Main Street within the Magnolia Avenue–Market Street corridor, where students will propose the urban retrofit of the current vacant parcels.

Critical and Creative Thinking - Design Methodology

This Design Studio employed a two-stage design methodology consisting of Critical Thinking and Creative Thinking**.** The first emphasizes analytical evaluation, while the second focuses on generating original ideas, guided by a project concept-name as the primary design driver. The Creative Thinking stage unfolds through four iterative phases: conceptualization, development, integration, and presentation.

Civic Engagement: Councilmember and Urban Planners' Participation

Design stages and phases with the participation of Councilmember and City Urban Planners:



Figures 1 and 2. Riverside Councilmember presenting the 2050 City Plan at CBU and Midterm review with City Councilmember and urban planners. Figures 3 and 4. Student Final presentation at City Hall with officials and urban planners.

Architectural Results (samples)



Figures 5, 6, and 7. Concept-names: "Citrus Commons", "Lattice Garden", "Crest View Heights"

Student Feedback

In addition to CBU's official course evaluations, which resulted in a score of 4.87 out of 5.00, a brief survey instrument was designed to assess students' perceptions of the course's pedagogical impact. All nine students of the course were invited to participate in the survey. Participation was voluntary and responses were collected anonymously. The survey was administered solely for educational research.

Question 1. To what extent did this course deepen your understanding of how architecture operates within real civic, urban, and environmental contexts?

1= Not at all, 2 = To a small extent, 3 = To a moderate extent, 4 = To a large extent, 5 = To a great extent.

Question 2. To what extent did engaging with city officials like the Councilmember and urban planners help you feel more prepared for professional architectural practice?

1= Not at all, 2 = To a small extent, 3 = To a moderate extent, 4 = To a large extent, 5 = To a great extent.

Question 3. What aspect of this project had the greatest impact on how you now understand the role of architecture in society and the city?

The mixed-format survey was designed to capture both quantitative indicators of perceived impact and qualitative insights into students' experiences. It was administered online at the end of the semester, with voluntary and anonymous participation and no identifying data collected. Quantitative responses were analyzed descriptively, while qualitative responses were examined thematically to identify recurring themes related to civic engagement, experiential learning, professional formation, ethical awareness, and the perceived role of architecture. Representative quotations were selected to illustrate these themes.

Quantitative Findings

Responses to both closed-ended survey questions reveal a consistently high perceived impact. For the first question—assessing the extent to which the course deepened students' understanding of architecture within real civic, urban, and environmental contexts—seven respondents (87.5%) selected the highest rating (5 = "to a great extent"), while one respondent (12.5%) selected a moderate rating (3), producing a mean score of 4.75. No respondents selected ratings of 1, 2, or 4.

The second question—measuring the extent to which engagement with city officials and planners contributed to students' sense of professional preparedness—produced an identical distribution: seven respondents (87.5%) selected 5, one respondent (12.5%) selected 3, and the mean score again was 4.75. This consistency suggests that students perceived a strong relationship between civic engagement and both intellectual growth and professional formation.

Qualitative Findings

The open-ended responses provide rich context for interpreting these numerical results. Across all responses, students articulated a clear shift in how they understood architecture, moving from an abstract design exercise toward a more civic, ethical, and relational conception of practice. Several students emphasized the importance of engaging with real stakeholders and described the experience as qualitatively different from previous studios. One student noted that working with the city planning department "helped the project feel more real than any other design project," highlighting a new understanding of communication and responsibility toward a client. Another reflected that feedback from council members transformed the project into "a realistic client experience," underscoring the perceived authenticity of the learning context.

Students also demonstrated heightened awareness of the broader forces shaping architectural decision-making. One response explicitly referenced zoning, community impact, sustainability, and long-term planning as factors that now shape the student's understanding of design, while another emphasized that architectural decisions are directly connected to civic goals and community needs. These reflections support the quantitative findings by illustrating how students internalized the civic dimension of architectural practice rather than merely recognizing it abstractly. A further recurring theme was the development of ethical and environmental awareness. Students spoke of responsibility toward long-term environmental impact, the importance of adaptive and earth-friendly solutions, and the realization that sustainability involves technical, social, and temporal dimensions rather than aesthetic gestures alone.

Most significantly, multiple responses articulated a transformation in students' understanding of architecture's role. One student stated that the project "reshaped how I understand the role of architecture within society and the city," while another concluded that the experience shifted their perspective from "simply creating buildings to shaping communities, supporting cities, and serving the people who inhabit them." These statements indicate not only learning outcomes, but a deeper process of professional and ethical formation.

Synthesis of Findings

Taken together, the quantitative and qualitative findings reinforce one another. The high mean scores indicate strong perceived impact, while the narrative responses clarify that this impact relates specifically to authenticity of learning, civic engagement, and ethical responsibility formation. Rather than functioning solely as an instructional exercise, the studio appears to have operated as a formative environment in which students encountered architecture as a public and socially embedded practice.

CONCLUSION

The *Real-World Architectural Projects* frames the design studio as a critical pedagogical site where architectural education engages civic responsibility rather than functioning as neutral skills training. Embedded within a real urban context, the studio bridges academic abstraction and social reality, positioning students as active participants in the production of public meaning. The studio operates as a form of critical spatial pedagogy, integrating experiential learning with ethical and civic orientation. Students engage in real institutional, social, and ecological conditions, while collaboration with municipal actors situates architectural ideas within authentic political and cultural frameworks. Rather than reducing education to professional training alone, this model cultivates critical consciousness and public agency, enabling students to envision socially responsible spatial futures. As a form of public scholarship, the studio contributes not only to professional competence but to the formation of reflective civic actors capable of shaping contemporary urban life.

NOTES

[1.] California Baptist University, *CBU Strategic Plan: Preparing Students to Live Their Purpose* (Riverside, CA: California Baptist University, 2022).
[2.] Leonardo da Vinci, *The Notebooks of Leonardo da Vinci*, ed. Irma A. Richter (Oxford: Oxford University Press, 2008), 17.
[3.] Phyllis C. Blumenfeld et al., "Motivating Project-Based Learning: Sustaining the Doing, Supporting the Learning," *Educational Psychologist* 26, no. 3–4 (1991): 369–398.
[4.] Donald A. Schön, *Educating the Reflective Practitioner* (San Francisco: Jossey-Bass, 1987), 40.
[5.] Kenneth Frampton, "Towards a Critical Regionalism: Six Points for an Architecture of Resistance," in *The Anti-Aesthetic: Essays on Postmodern Culture*, ed. Hal Foster (Seattle: Bay Press, 1983), 20.
[6.] Ernest L. Boyer, *Scholarship Reconsidered: Priorities of the Professoriate* (Princeton, NJ: Carnegie Foundation for the Advancement of Teaching, 1990), 23.
[7.] Ernest L. Boyer, *The Boyer Commission on Educating Undergraduates in the Research University* (Stony Brook, NY: State University of New York, 1998), 15.
[8.] Henry A. Giroux, *Teachers as Intellectuals: Toward a Critical Pedagogy of Learning* (South Hadley, MA: Bergin & Garvey, 1988), 121.
[9.] Gert Biesta, *The Beautiful Risk of Education* (Boulder, CO: Paradigm Publishers, 2013), 19.
[10.] Donald A. Schön, *The Reflective Practitioner: How Professionals Think in Action* (New York: Basic Books, 1983), 68.
[11.] Leon Battista Alberti, *On the Art of Building in Ten Books*, trans. Joseph Rykwert, Neil Leach, and Robert Tavernor (Cambridge, MA: MIT Press, 1988), 3.
[12.] Gert Biesta, *Good Education in an Age of Measurement: Ethics, Politics, Democracy* (Boulder, CO: Paradigm Publishers, 2010), 75
[13.] Gert Biesta, *The Beautiful Risk of Education* (Boulder, CO: Paradigm Publishers, 2013), 18–22.
[14.] Etienne Wenger, *Communities of Practice: Learning, Meaning, and Identity* (Cambridge: Cambridge University Press, 1998), 8.
[15.] Ernest L. Boyer, *Scholarship Reconsidered*, 24.
[16.] Ernest L. Boyer and Lee D. Mitgang, *Building Community: A New Future for Architecture Education and Practice* (Princeton, NJ: Carnegie Foundation for the Advancement of Teaching, 1996), 7.
[17.] City of Riverside, *Riverside General Plan 2050* (Riverside, CA: City of Riverside Planning Department, 2021).
[18.] Genesis 2:15 (New Revised Standard Version).
[19.] Isaiah 65:21 (New Revised Standard Version).
[20.] Acts 2:44–47 (New Revised Standard Version).
[21.] Ebenezer Howard, *Garden Cities of To-Morrow* (London: Swan Sonnenschein, 1902); Le Corbusier, *The Radiant City* (New York: Orion Press, 1967).
[22.] City of Riverside, *Climate Action and Adaptation Plan (CAAP)* (Riverside, CA: City of Riverside, 2018).

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TOWARDS A PEDAGOGICAL FRAMEWORK FOR BIM-ENABLED DESIGN EDUCATION: INTEGRATING LEARNING THEORIES AND PERFORMANCE-DRIVEN DESIGN

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INTRODUCTION

Architecture education faces the multifaceted challenge of fostering creativity and autonomy, ensuring the technical competencies required by the contemporary practice, and addressing global sustainability concerns. In particular, international commitments such as the Paris Climate Agreement and national targets for reducing building energy consumption have raised sustainability concerns. To reduce the energy consumption of buildings, as La Roche argues, architecture schools are required to teach low-energy building design.[1]

Within this context, Building Information Modeling (BIM) stands as a powerful approach; however, as Benner and McArthur point out, its use in architectural education is often limited to technical aspects of design processes and construction-oriented tasks.[2] This narrow adoption overlooks BIM's potential to support performance-driven design[3] in earlier phases, where design decisions have the greatest impact on building energy performance.

In parallel, the complexity of BIM environments, which are mostly developed for professional practice rather than educational use, presents additional pedagogical challenges. Alassaf warns that the complexity of BIM interfaces may overwhelm novice learners, especially when combined with the cognitive demands of architectural design processes.[4] Furthermore, while there is a growing emphasis on performance-based design education, there is currently no established methodology for effectively integrating performance simulation workflows into architectural design education.[5] Together, these issues point to an unresolved situation: despite widespread adoption of BIM technologies, the pedagogical role of BIM, especially within the performance-driven and sustainability-oriented building design context, remains unclear.

This uncertainty highlights the need for a systematic investigation into how and to what extent existing research addresses the pedagogical foundations of BIM-enabled, performance-driven education. Concurrently, design studios continue to rely heavily on minimally guided pedagogies.[6] While such approaches may encourage independence and foster creativity, they often fail to provide sufficient scaffolding,[7] particularly for more demanding design approaches such as performative design. Together, these tendencies reveal a critical pedagogical gap.

This study addresses this gap by systematically investigating the pedagogical landscape at the intersection of architectural education, BIM, and sustainability, specifically analyzing the theoretical

and methodological trends and limitations in how BIM-enabled, performance-driven design is integrated and researched. The study also aims to derive foundational guiding principles, defined in terms of theoretical foundations, instructional strategy, and research design; which will inform the development of a pedagogical framework in subsequent phases of the research. The scope of this work is deliberately focused: it is based on a systematized review of the literature to extract guiding principles for a pedagogical framework, rather than proposing a complete, comprehensive pedagogical framework at this stage. The detailed development and empirical testing of the framework will be carried out in later phases of this research.

CONCEPTUAL APPROACH

This study adopts a two-phased review approach to construct the conceptual basis of the proposed BIM-enabled pedagogical framework.

Rather than directly engaging with existing empirical studies, the study first establishes a pedagogical lens in the first phase. The purpose of this phase is not the provide a comprehensive review of learning theories, but to identify core principles related to the cognitive mechanisms, such as managing cognitive load and ensuring instructional scaffolding, involved in learning complex design processes within BIM environments. This approach is grounded in the assumption that the challenges of integrating BIM into design education are not simply technical, but fundamentally cognitive and pedagogical challenges.

The second phase follows a systematized literature review structure. A systematized literature review can be defined as a structured review approach that adopts elements of systematic reviews, while remaining flexible in scope and depth.[8] Building on the pedagogical lens established in the first phase, this review aims to analyze the existing pedagogical landscape at the intersection of architectural education, Building Information Modeling (BIM), and sustainability, with a focus on building energy usage. Specifically, the review investigates how existing studies conceptualize the pedagogical role of BIM, which instructional strategies and learning theories are adopted, and how these studies are methodologically designed. These questions guide the identification of pedagogical patterns, limitations, and gaps within the current body of research.

To ensure transparency and replicability, this systematized review process follows the PRISMA guidelines (Preferred Reporting Items for Systematic reviews and Meta-Analysis).[9] Adopting this structure allows for providing the transparency of the individual steps in the search process and replicability of the review for subsequent researchers.

LEARNING THEORIES AND ARCHITECTURE EDUCATION

Learning is defined as the act of acquiring knowledge or skill through systematic study, practice, or experience.[10] Understanding learning processes is essential for developing effective educational strategies, particularly in architecture education where complex cognitive processes play a crucial role. Broadly, learning theories are commonly categorized into three major perspectives: behaviorism, cognitivism, and constructivism.[11]

Behaviorism conceptualizes learning as a transformation in observable behavior resulting from environmental stimuli and reinforcement.[12] From this perspective, internal mental processes are secondary; instead, learning outcomes are shaped through repetition, feedback, and external control. While these approaches are effective for acquiring basic skills, they are limited when addressing complex, non-linear activities[13] such as architectural design. Cognitivism, in contrast, shifts the focus to internal mental processes, viewing learning as active information processing.[14] By emphasizing instructional scaffolding and the management of cognitive load, cognitivist approaches are effective

for tasks involving high levels of complexity and abstraction.[15] Constructivism conceptualizes learning as an active, context-sensitive process in which learners construct meaning through experience, interaction, and reflection.[16]

In the context of architectural education, the pedagogical landscape is heavily shaped by constructivist principles,[17] most notably formalized through Donald Schön's[18] theory of "reflective practice." The design studio, as the core of this education, acts as a constructivist learning environment that prioritizes "learning by doing", engagement with ill-defined problems, and exposure to authentic, complex tasks. However, this approach presents significant challenges and needs to be discussed for further improvements. As Webster argues, the field has remained largely un-theorized since Schön,[19] and the intended outcomes are often communicated only implicitly.[20] Studio discussions generally focus on the "product", leaving the "process" of designing implicit and rarely discussed.[21] Van Dooren highlights that this lack of explicit guidance often leads to confusion for beginning students, who struggle to navigate the ambiguity of the design process without sufficient support.[22]

The reliance on implicit, minimally guided pedagogies becomes particularly problematic when introducing high-complexity digital tools and dealing with the increasing demands of performance-driven design expectations. Consequently, pedagogy must evolve to address these new challenges, bringing the central missing element: cognitive support. This is critical, because, as Kirschner and his colleagues identified, the epistemology of practice (how an expert works in a domain) is not equivalent to the pedagogy of the domain (how a novice learns it). Consistent with this view, empirical evidence shows that, minimal guidance approaches are less effective and less efficient for novices than structured guidance.[23]

However, this doesn't mean that the reflective studio model should simply be replaced; instead, it should be strengthened. As Ertmer and Newby emphasize, no single theory can address the full complexity of any instructional setup.[24] Therefore, this study adopts the "systematic eclecticism" approach proposed by Snelbecker.[25] This perspective argues for the strategic selection and adaptation of different learning theories to suit specific phases and needs of instruction. By adopting elements from behaviorism (such as gamification approaches and reward-based mechanisms) to support basic skill acquisition, integrating principles from cognitivism (such as structured guidance) to manage cognitive load, alongside constructivist approaches (such as open-ended exploration) for design synthesis, it is possible to create a pedagogical framework that manages the complexity of the design studio, while providing the necessary cognitive support for novice learners. This theoretical positioning forms the basis for the systematized review and the conceptual framework proposed in this study.

BIM AND SUSTAINABLE DESIGN EDUCATION: A SYSTEMATIZED REVIEW OF THE PEDAGOGICAL LANDSCAPE

This section presents the methodology and key findings of the systematized literature review. Guided by the pedagogical lens established in the previous section, the review examines how current research at the intersection of architectural education, BIM, and sustainability addresses pedagogical foundations, instructional approaches and how these topics have been investigated methodologically. The purpose of this section is not only to map the field, but also to identify structural gaps that inform the need for alternative pedagogical frameworks.

Review Process and Screening

As stated in the Conceptual Approach section, this systematized review was guided by PRISMA[26] principles. Two major academic databases -Scopus and Web of Science (WoS) Core Collection- were selected as the primary sources of data due to their broad coverage of peer-reviewed literature. The

search strategy used for this review is intentionally structured to be comprehensive in order to increase the possibility of reaching all relevant literature, while decreasing the retrieval of out-of-scope results. The final search strings were developed through numerous iterative trials to optimize this balance, and are presented in Table 1.

Database	Search Strings
Scopus (142)	TITLE-ABS-KEY-AUTH (("ARCHITECTURE PEDAGOGY" OR "architectural pedagogy" OR "Architectural Education" OR "Architecture Education" OR "Education in Architecture" OR "Architectural Studio" OR "Architecture Studio" OR "Architectural Course" OR "Architecture Course" OR "Design Studio" OR "Design Education" OR "Design course" OR "Architectural Curriculum" OR "Architecture Curriculum" OR "Architectural Curricula" OR "Architecture Curricula" OR "Design Curricula" OR "Design Curriculum" OR "architecture teaching" OR " teaching in architecture" OR "architectural instruction") AND ("digital" OR "parametric" OR "Building Information Modeling" OR "architecture information modeling" OR "Information modeling" OR "BIM" OR "BIM ENABLED LEARNING" OR "BIM-ENABLED LEARNING" OR "BIM ENABLED TEACHING" OR "BIM-ENABLED TEACHING") AND ("SUSTAINABILITY" OR "SUSTAINABLE DESIGN" OR "ENERGY EFFICIENCY" OR "ENERGY EFFICIENT" OR "6D" OR "6D-BIM" OR "performative design" OR "performance based design"))
Web of Science (80)	("ARCHITECTURE PEDAGOGY" OR "architectural pedagogy" OR "Architectural Education" OR "Architecture Education" OR "Education in Architecture" OR "Architectural Studio" OR "Architecture Studio" OR "Architectural Course" OR "Architecture Course" OR "Design Studio" OR "Design Education" OR "Design course" OR "Architectural Curriculum" OR "Architecture Curriculum" OR "Architectural Curricula" OR "Architecture Curricula" OR "Design Curricula" OR "Design Curriculum" or "architecture teaching" or " teaching in architecture" or "architectural instruction") (Topic) and ("digital" or "parametric" or "Building Information Modeling" or "architecture information modeling" or "Information modeling" or "BIM" OR "BIM ENABLED LEARNING" OR "BIM-ENABLED LEARNING" OR "BIM ENABLED TEACHING" OR "BIM-ENABLED TEACHING") (Topic) and ("SUSTAINABILITY" OR "SUSTAINABLE DESIGN" OR "ENERGY EFFICIENCY" OR "ENERGY EFFICIENT" OR "6D" OR "6D-BIM" OR "performative design" OR "performance based design") (Topic)

Table 1. Databases, search strings and retrieved results

The initial search retrieved 142 publications from Scopus and 80 from Web of Science, resulting in a total of 222 publications. All retrieved publications were exported into a spreadsheet application (MS Excel) for initial screening and management. Within this application, 61 duplicates were removed first, leaving 161 unique articles.

Inclusion	Exclusion
Studies focused architecture field and building design	Studies related with other fields than architecture (interior design, industrial design, landscape architecture, textile design, graphic design etc)
Studies focused on either sustainable and energy efficient architectural design or BIM	Studies focused on other types of sustainability concerns, but not related with building design
Studies focused on education, pedagogy, formal or informal teaching	Practice oriented studies, that doesn't related with education
Peer-reviewed articles, conference proceedings, book sections	Conference review texts, editorials etc.
Studies with full text available	Studies with full text unavailable

Table 2. Inclusion and exclusion criteria

These 161 articles were then subjected to a screening process, based on titles, keywords and abstracts according to the inclusion and exclusion criteria presented in Table 2. Following this stage, 103 publications were excluded due to a lack of relevance to the research focus, leaving 58 articles for further screening. Based on the publication type criteria, 16 conference review texts are excluded, as these publications generally consisted of general descriptive or introductory overviews of conference themes. Lastly, 6 publications were excluded due to the unavailable full text. This process resulted in a final sample of 36 studies included in the analysis. The flow of this entire screening process is visually summarized with the PRISMA flow diagram in Figure 1.

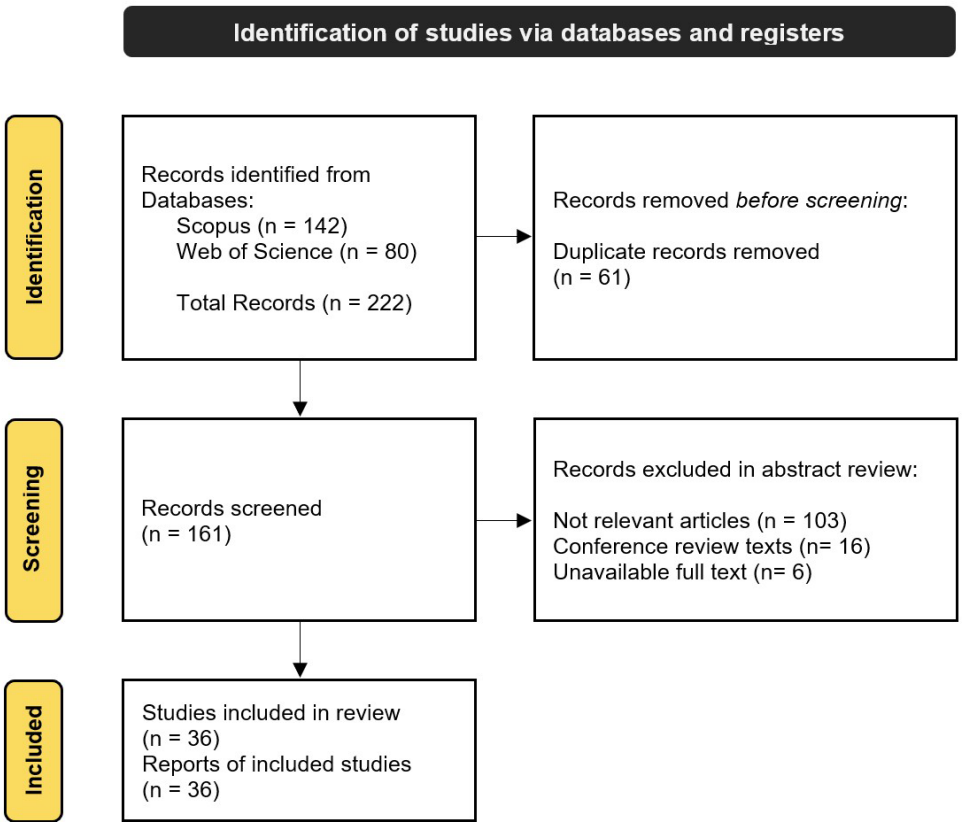


Figure 1. Prisma Flow diagram

Analysis of Findings

The 36 selected studies were analyzed to address the two Research Questions (RQs):
1. What is the general landscape at the intersection of architectural education, BIM, and sustainability in terms of study types and methodological rigor?
2. Which pedagogical model, learning theories or instructional strategies are adopted in these studies?

RQ 1: Research Landscape and Methodological Rigor:

To address the first research question, the studies were initially classified according to their core research approach. Of the 36 studies, 24 were identified as empirical studies and 12 were identified as conceptual studies. The conceptual studies constituted a relatively homogeneous group, consisting of 7 theoretical discussion and proposal papers and 5 literature reviews. In contrast, the empirical studies were dominated by case study research, with 21 studies adopting this approach. The distribution of study types and data collection approaches is summarized in Figure 2. This represents a key finding: the empirical evidence in this field relies almost entirely on case-based investigations.



Figure 2. Distribution of reviewed studies by research approach (inner ring) and data collection methods (outer ring)

A closer examination of these case studies reveals a clear trend. 20 of the 21 case studies collected data within semester-long design courses. While such settings offer highly realistic results and reflect educational conditions, they suffer from limited experimental control. External factors and distractions may influence the results, making it difficult to demonstrate that the pedagogical intervention alone caused the observed outcomes. A stronger methodological approach, which is absent from reviewed studies, would involve a multi-phase or longitudinal research design; in which pedagogical interventions are first tested in more controlled settings such as workshops or design charrettes, refined based on feedback, and subsequently implemented within semester-long courses.
The data collection methods used in these case studies also reveal a notable pattern. 12 of these 21 case studies relied primarily on qualitative measures, with observational data forming the main source of evidence. Seven additional studies complemented observational data with quantitative measures such as surveys, questionnaires and performance metrics. Importantly, none of the reviewed studies employed a methodologically rigorous pre-test/post-test control group research design. This highlights a significant research opportunity: adopting more robust experimental designs could substantially strengthen the empirical evidence regarding pedagogical effectiveness in BIM-enabled design education.

RQ 2: Pedagogical Foundations and Instructional Strategies

The second research question focuses on the pedagogical foundations of the reviewed studies and it constitutes a central dimension of this study. It has been asked that, what pedagogical model, learning theories or instructional strategies are adopted in these studies.

First, the majority of these case studies, over 80% of them, did not explicitly reference any learning theory or pedagogical model in the design of their instructional interventions. Only four studies referred their studies to learning theories, and they referred to constructivist pedagogy, experiential learning theory, situated learning and activity theory.

A similar pattern emerges, when instructional strategies are examined. 16 of the 21 case studies adopted project-based or experientially oriented instructional approaches. These instructional strategies are closely associated with constructivist and minimal-guidance pedagogical philosophies.

When considered together, these findings reveal a clear and consistent pattern, indicating that the pedagogical landscape of the field is narrow in terms of pedagogical diversity and largely homogeneous in its reliance on constructivist, minimally guided approaches. This highlights another significant research opportunity: integrating proven instructional designs grounded in learning theory and incorporating structured guidance has the potential to broaden and strengthen pedagogical practices in BIM-Enabled, sustainability-oriented architectural education.

A detailed analysis of the reviewed studies is provided in Table 3.

Author and Date	RA	RD	RS	DC	Pedagogic Approach	Learning Theories
Iordanova (2007)	E	CS	FS (SL)	QL	EL	Proximal zone learning
Holzer (2008)	E	CS	FS (SL)	QL	Not specified	Not mentioned
La Roche (2008)	C	T	FS (SL)	-	-	-
Oxman (2008)	C	T	-	-	-	-
Iordanova et al. (2010)	E	CS	LS(3x2D)	QL	Collaborative learning	Socio-constructivist theory, Situated learning, activity theory
Rashed-Ali et al. (2010)	E	CS	FS (SL)	QL	Not specified	Not mentioned
Vassigh and Herrera (2010)	C	T	-	-	-	Not mentioned
Becerik-Gerber et al. (2011)	E	SB	-	QT	-	-
Doelling and Nasrollahi (2012)	E	CS	FS (SL)	QL	PBL	Not mentioned
Spiegelhalter (2012)	C	T	-	-	-	-
Doelling and Jastram (2013)	E	CS	FS (SL)	QL	PBL	Not mentioned
Janusz (2013)	E	CS	FS (SL)	QL	PBL	Not mentioned
Alwan et al. (2014)	E	CS	FS (SL)	M	EL, self-directed learning, PBL	Not mentioned
Gamble et al. (2015)	E	CS	FS (SL)	QL	Not specified	Not mentioned
Li et al. (2017)	C	LR	-	QT	-	-
Elesawy et al. (2018)	E	CS	FS (SL)	M	PBL	Not mentioned
Benner and McArthur (2019)	E	CS	FS (SL)	M	EL, PBL	Constructivist pedagogy
Uduku et al. (2020)	E	SB	FS (SL)	QL	Student centered learning, EL	Not mentioned
Xiang et al. (2020)	E	CS	-	QL,	-	-
Gottkehaskamp and Willmann (2022)	E	CS	FS (SL)	QT	Flipped classroom,	Not mentioned
Milic et al. (2022)	E	CS	FS (SL)	QL	Active learning, EL	Not mentioned
Gunasagaran et al. (2023)	E	SB	-	QT	-	-
Wang et al. (2023)	E	CS	FS (7W)	M	EL, PBL	Not mentioned
Almaz et al. (2024)	E	CS	FS (SL)	QL	EL, PBL	Not mentioned
Di Marco and Lombardi (2024)	C	T	-	-	-	-
Hammadamin and Nordin (2024)	C	LR	-	QL	-	-
Abdelrahim et al. (2025)	E	CS	FS (SL)	QT	EL, PBL	Not mentioned
Butt et al. (2025)	C	T	-	M	-	-
Cenk and Selçuk (2025)	C	LR	-	QL	-	-
Jin et al. (2025)	C	LR	-		-	-
Kepczynska-Walczak (2025)	E	CS	FS (SL)	M	EL, PBL, e-Learning, self-directed learning	Not mentioned
Köse and Gümüşburun Ayalp (2025)	C	LR	-	QT	-	-
Massoud (2025)	C	T	-	M	Unspecified	Not mentioned
Naboni et al. (2025)	E	CS	FS (SL)	M	EL, PBL,	Experiential Learning Theory
Naboni et al. (2025)	E	CS	FS (SL)	M	EL, PBL,	Experiential Learning Theory
Wang et al. (2025)	E	CS	FS (6W)	QL	Design-oriented teaching, PBL,	Not mentioned

RA: Research Approach (E: Empirical, C: Conceptual)
RD: Research Design (CS: Case Study, SB: Survey Based, T: Theoretical Discussion, LR: Literature Review)
RS: Research Setup (FS: Field Study, LS: Laboratory Study, SL: Semester Long, W: Weeks, D: Days)
DC: Data Collection: (QL: Qualitative, QT: Quantitative: M: Mixed)
EL: Experiential Learning, PBL: Project Based Learning

Table 3. Detailed analysis of the reviewed 36 studies.

SYNTHESIS: GUIDING PRINCIPLES FOR A BIM-ENABLED PEDAGOGICAL MODEL

The reviewed literature covers diverse sustainable design topics, such as performance-based design, net-zero energy strategies, passive solar architecture, circular economy, AI integration and sustainable heritage preservation. While these studies demonstrate the wide application of digital tool integration, the majority of them utilized BIM and other computational environments merely as technical instruments, and focused on their design, simulation or representation capabilities, rather than utilizing them as an instructional medium. Consequently, the existing research landscape reveals significant gaps: the theoretical foundation of learning is not often discussed, the educational process is rarely approached with an explicit instructional design perspective, and the research methodology is often remains descriptive. Addressing these identified gaps, this study proposes a set of guiding principles for a BIM-enabled pedagogical model structured on three main pillars: theoretical foundation, instructional strategy, and research design.

First, regarding theoretical foundations, the review reveals a lack of explicit pedagogical grounding on most studies, along with an implicit reliance on constructivist approaches in some other studies. In response, this study advocates a position of systematic eclecticism, explicitly combining principles from Cognitive Load Theory to support skill acquisition with structurally guided constructivist approaches for to facilitate design exploration. This combination is intended to address both cognitive demands of learning performance-driven building design within BIM environments and the exploratory nature of architectural design processes.

Second, in terms of instructional strategies, the literature is dominated by minimally guided, project-based learning approaches, which are often criticized for their relatively unstructured nature, limited scaffolding to support complex learning processes and underlying cognitive mechanisms, and their potential to result in learning inefficiencies.[27] To address these limitations, a two-phased instructional strategy is proposed. Foundational technical skills are delivered through a flipped classroom model that enables self-directed and self-paced learning. This approach may be further strengthened through the use of a Learning Management System incorporating gamification elements to enhance learner motivation. Studio time is then allocated to just-in-time instructional guidance, allowing instructors to provide targeted procedural support related to design logic and performance-based reasoning in a progressively increasing task complexity, while also reducing the risk of misconceptions regarding sustainability principles.

Finally, regarding research design, the review demonstrates a heavy reliance on descriptive case studies with limited methodological rigor. To strengthen empirical evidence in the field, this study proposes a longitudinal mixed-methods research design incorporating pre-post testing, control groups, and iterative implementation phases. Such an approach would support more solid evaluation of pedagogical effectiveness in BIM-enabled design education within performance-driven design contexts.

These three guiding principles are synthesized and summarized in Table 4, which outlines the proposed BIM-enabled pedagogical model across theoretical, instructional and methodological dimensions.

Dimension	Current Approaches in the Literature	Guiding Principles for an Enhanced BIM-Enabled Pedagogical Model
Theoretical Foundation	Lack of theory or dominance of constructivism	Cognitive Load Theory and Systematic Eclecticism
Instructional Strategy	Minimally guided project-based learning and experiential learning	Flipped classroom supported by LMS, scaffolded & structured guidance, just-in-time guidance sequenced tasks with progressive complexity
Research Design	Descriptive case studies; No control group testing	Longitudinal mixed-methods approach (Pilot workshop testing followed by semester-long course implementation), pre/post – test control group design

Table 4. Synthesis of findings from the literature and corresponding guiding principles for BIM-Enabled pedagogical model

CONCLUSION AND FUTURE WORK

To conclude, this study demonstrates that the existing literature at the intersection of architecture education, BIM, and sustainable design largely lacks explicit pedagogical foundations and methodologically rigorous evaluation approaches. In response, the contribution of this study lies in articulating a critical pedagogical discussion and proposing a set of guiding principles aimed at the development of a more structured, theory-informed instructional model for BIM-Enabled sustainable design education. These principles are structured around three core dimensions: theoretical foundation, instructional strategy, and research design. Within these dimensions, the study specifically advocates for adapting systematic eclecticism to balance skill acquisition and design exploration, implementing structured scaffolding to manage cognitive load, and utilizing longitudinal mixed-methods research designs for rigorous empirical validation.

It is acknowledged that this study has two main limitations. First, the proposed pedagogical framework remains at a conceptual level, and has not yet been empirically tested. Second, the framework is derived from a systematized review based on a deliberately focused body of literature, rather than a fully comprehensive review of the field. Addressing these limitations, future work will focus on the translation of these principles into a concrete educational framework through a multi-layered research trajectory. The initial phase will involve the development of a comprehensive instructional infrastructure, including BIM-enabled learning documents, smart object libraries, customized project templates for performance-driven design education, and site-specific climate datasets, to reduce extraneous cognitive load for novice learners. Following this preparation, the instructional content will be structured to align with instructional design principles, to facilitate structured scaffolding for effective learning. The subsequent phases will involve longitudinal testing, initially through controlled workshop implementations to refine materials and strategies, and finally, through a semester-long course to empirically evaluate the effectiveness of the framework.

Beyond the specific context of BIM and sustainability, this study also offers broader pedagogical implications for architectural education. The findings suggest that the lack of explicit instructional design and theoretical grounding identified here might be a recurring issue within other aspects of

architecture education field. Therefore, the theory-informed and systematically structured approach proposed in this study offers a potentially transferable model, encouraging educators and researchers to reconsider how complex architectural skills could be taught and evaluated within research settings.

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THE NEGLECT AND IMPORTANCE OF SPATIAL PRACTICE IN ARCHITECTURAL EDUCATION

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INTRODUCTION

Space use continuously evolves in response to technological advancement, shifting societal needs, and global challenges.[1] The failure of buildings to accommodate changing spatial requirements[2] increases financial, environmental, and social costs, leads to operational inefficiencies and resource wastage, and results in expensive adaptations or premature obsolescence.[3]

Literature suggests that the built environment affects human health and well-being, as well as operational performance.[4] Despite this impact, a disconnect exists between how designers conceive spaces and how occupants use and experience them.[5]

Architects and students often design without understanding actual space use[6] and rely on minimum standards, subjective assumptions, and biases rather than empirical evidence.[7] Till describes contemporary architectural education as perpetuating deluded detachment into a rarefied and self-referential world.[8]

This becomes particularly acute in strongly programmed, institutional, or complex typologies, such as healthcare environments, that lie outside the designer's frame of reference and where operational requirements, regulations, and human needs create competing spatial demands.[9] The result is environments that fail to support intended functions, contribute to operational inefficiencies, and undermine human health and wellbeing.[10]

Spatial practice emerged as a useful concept for exploring these challenges. Spatial practice is the way humans use, organise, and interact with physical space through individual and communal actions. Spatial practice is observable and measurable, positioning it as a potential indicator of building performance. The tacit knowledge embedded in spatial practices also represents valuable content for evidence-based design in architecture education and practice.[11] However, methodological limitations, disciplinary silos, research-practice gaps, and the nature of architectural practice inhibit feedback loops.

This raises the question: how can architecture students and practitioners better understand spatial practice in complex contexts to inform evidence-based design?

The research employed a scoping literature review as part of a PhD investigation, tracking the evolution and neglect of spatial practice in architecture, conceptualising it across interdisciplinary literature, and outlining associated challenges. The objective of the review was to develop a framework that equips students and practitioners to investigate spatial practice, moving beyond abstract and deterministic programming towards empirical investigation of actual space use in real-

world contexts to inform more appropriate design responses. It recognises existing buildings as repositories of spatial knowledge and reframes spatial practice as valuable design intelligence.
Building on review findings, a pedagogical approach was developed and implemented in postgraduate architecture projects. Students engaged with theoretical frameworks and employed multiple research methods, including media analysis, ethnographic observation, document analysis, spatial analysis, and walking as a critical spatial practice, to gain knowledge of spatial practices that could inform design choices.

EVOLUTION AND NEGLECT OF SPATIAL PRACTICE IN ARCHITECTURE

Architecture's history reveals persistent tension between form, function, and lived experience. Vitruvius's triad positioned architecture as a balance between structural integrity, functionality, and beauty. Classical and Renaissance approaches grounded design in human proportions and experience. However, enlightenment witnessed a shift as rationalism demanded precise measurement, with abstract standards based on utility and efficiency. Industrialisation reduced modern social ideals and reinforced mechanistic understandings of space. Modernist form-follows-function ideals reduced architecture to instrumental pursuit, criticised by Mumford for possessing only the "visual illusion of functionalism without achieving true functionality or satisfying human needs."[12] Post-war consumerism incorporated functionalism into sterile aesthetic uniformity, whilst postmodern architecture prioritised cultural critique and symbolism over lived experience.[13]
Architectural education mirrored this shift. The Académie d'Architecture (1671) and École des Beaux-Arts (1807) formalised design as an intellectual pursuit, abstracting it from everyday realities. The Bauhaus (1919) briefly reconnected design with making, but its successors reabsorbed training into professionalised and accredited systems. Contemporary education and practice continue to prioritise formal mastery and, more recently, sustainability and technology over understanding lived spatial experience and human use.[14] It seems that architecture education has neglected its first principles.
Despite embracing a user-centred rhetoric and claims of prioritising user well-being, few designers can accurately report how spaces are truly experienced or used.[15] According to the literature, the neglect of spatial practice manifests in troubling ways. Reducing complex human interactions to metrics and minimum standards disembodies design from its purpose, producing static environments.[16] Brand argues that when programming overemphasises immediate user needs, it produces functionalist determinism and fosters long-term inflexibility, with consequences extending beyond functional limitations to shape social dynamics.[17] Ng et al. demonstrate that designs often fail due to a lack of focus on the sociality of spaces.[18] Many scholars agree that successful architecture stems from understanding the multifaceted needs of human use.[19] Sailer et al. ask: "Could our understanding of the social life of buildings be enhanced by a more detailed description of different levels or layers of programming?"[20] It is becoming clear that architectural education should engage more deeply with spatial practices.[21] Especially considering the emergence of AI and its impact.

CONCEPTUALISING SPATIAL PRACTICE

The spatial turn emerged in the 1970s and 1980s, when scholars identified a longstanding bias that privileged time over space. The reciprocal social turn emerged from the mid-1980s onwards, reorienting architectural history to include broader social contexts.[22] Building on Bourdieu[23] and Giddens,[24] the practice turn, formalised by Schatzki, Knorr Cetina and Von Savigny, positions practices as organised human activity through which spaces are produced.[25] These movements converge to position spatial practice at the intersection of space, practices, and social dimensions.[26]
Theoretically, spatial practice draws from an interdisciplinary landscape of thinkers who expand the understanding of space beyond physical dimensions to integrate social, political, and experiential

aspects. Heidegger's[27] phenomenological approach distinguished "space" and "place", where space is "co-constituted by practice and invested by meaning".[28] Foucault[29] analysed space as materialised power relations and control mechanisms embedded in social practices. Harvey[30] and Massey[31] established that space is socially produced through practice—neither fixed nor universal but historically specific—with Harvey emphasising spaces as both instrument and evidence of uneven power dynamics.

De Certeau distinguishes between strategies—institutional actions that control space—and tactics, the user's improvisations that navigate imposed spatial orders.[32] Lefebvre's spatial triad defines space as a dynamic interaction among conceived space (design intentions), perceived space (the physical world), and lived space (human experience).[33] Schatzki's site ontology and practice theory conceptualise practice-arrangement bundles where physical spaces and human activities mutually constitute each other.[34] Rendell's critical spatial practice bridges art and architecture through site-specific interventions that question boundaries, analyse spatial conditions and challenge power structures.[35]

Lussault and Stock propose shifting from being in space to doing with space.[36] Koch and Steen demonstrate that workflows in strongly programmed spaces create spatial practices that balance functional performance with communication and well-being.[37] Space syntax theory defines strong programmes through rigid hierarchies and segregated layouts,[38] creating inflexibility where spatial configurations dictate use patterns. Raulet-Croset and Borzeix frame spatial practice as co-construction, where space functions as both producer and product.[39] Buchert notes that tacit dimensions form "part and parcel of practice".[40] Ng et al. demonstrate that spatial practice mediates between conceived and lived space by documenting user adaptations.[41] The knowledge that users develop through everyday spatial interaction, beyond design intentions, is integral to spatial practice.

This framework recognises space as socially constituted through reciprocal relationships between spatial form and human action, where space and practices shape each other while negotiating between conceived intentions and lived experiences.[42] Spatial practice represents pedagogical content often hidden within everyday space use,[43] highlighting the need for architectural education to examine existing spatial practices and cultivate understanding of how people actually use space.

DISCIPLINARY AND METHODOLOGICAL APPROACHES AND CHALLENGES

Despite rich theoretical literature, there remains a lack of engagement from spatial disciplines.[44] Few studies produce empirical knowledge that could support evidence-based design despite spatial practice being integral to building performance.[45] Stock highlights this methodological challenge, noting that "investigating practices is now a common methodological problem within geography... Yet, practices are too often approached without the spatial dimensions, thus giving away the specific geographical advantage of the observation of practices as containing also spatial problems."[46]

Research approaches to spatial practice reflect disciplinary biases that prioritise certain aspects whilst neglecting others.[47] Architectural research emphasises physical form, spatial qualities, and aesthetics over programme, function, and nuances of use.[48] Operations research and engineering prioritise operational performance through efficiency and workflow optimisation, but treat space as a background variable rather than an active agent.[49] User experience studies prioritise spatial experience and subjective perceptions but rarely analyse how these relate to spatial practice and operational demands.[50] Management studies have historically neglected spatial dimensions,[51] while space syntax, although addressing spatial use and configuration, has been criticised for being clinical and unable to capture tacit, qualitative nuances.[52] Even ergonomics, which connects space and activity, leaves space poorly conceptualised.[53]

Methodologically, approaches typically address isolated aspects rather than interconnected layers.[54] The phenomenon represents a complex system where interactions between space, practice, and

inhabitants require holistic study.[55] Raulet-Croset and Borzeix propose commented walks to capture how actors "deal with space" and the materiality and feelings space inspires.[56] Taylor and Spicer suggest combining observation, interviews, spatial mapping, and textual analysis.[57] However, each method captures certain aspects but fails to provide comprehensive understanding: space syntax quantifies spatial configuration-behaviour relationships but cannot account for protocols or experiences;[58] observations document spatial use patterns but miss motivations;[59] post-occupancy evaluation captures experience, use, and physical dimensions but lacks connection between these;[60] and process mapping reveals operational workflows but neglects spatial dimensions and represents ideal rather than actual practices.[61]

Methodological limitations, disciplinary silos, research-practice gaps, and the nature of architectural practice inhibit potentially valuable feedback loops between spatial practice and conceived space.[62] Academic timelines, access constraints, resource limitations, and ethical boundaries can render empirical spatial practice research unachievable, often limiting students and practitioners to abstract desktop studies removed from real contexts, experiences, and uses. Additionally, challenges of translating theory into design make it tempting to resort to regulations and social media precedents.

Tacit knowledge embedded in spatial practices represents a valuable but often inaccessible resource for evidence-based design. This knowledge is difficult to articulate and document, remaining in unconscious adaptations. Sailer et al. identify a critical divide between architectural researchers and practitioners, with this separation leading to poor designs and research failing to impact real-world spatial designs.[63] A methodological gap remains in accessing, analysing, and disseminating the knowledge embedded in spatial practice. Architectural education must equip students to access and translate this knowledge into design intelligence, bridging academic pedagogy with industry needs in sustainability and adaptive reuse. Despite challenges, opportunities exist for developing integrated frameworks to understand how places are inhabited.[64]

A comprehensive methodological framework for integrating spatial practice analysis, operational performance evaluation, and human outcome assessment remains underdeveloped. The challenge lies in developing methods that can access different dimensions of this complex phenomenon and create integrated approaches that reveal complex interrelationships whilst translating insights into formats that can inform design processes.[65] Consequently, developing such a theoretical and methodological framework would significantly advance spatial practice research.

Designers rarely evaluate how buildings perform after occupation, creating a critical gap in professional knowledge development.[66] This broken feedback loop perpetuates design approaches that prioritise physical form over actual use patterns.

PEDAGOGICAL APPLICATION IN STUDENT PROJECTS

This pedagogical approach integrates theoretical frameworks with the study of spatial practice prior to design development. This enables students to create design guidelines grounded in theory but informed by actual use and real human needs. The approach was tested in three postgraduate studio projects through varying methods.

The first project designed temporary performance spaces in an urban park, exploring performance as a critical spatial practice and addressing how the 1892 Victorian garden design (conceived space) no longer aligns with diverse current activities (spatial practice) and user experiences (lived space). The three-phase methodology initially studied theory on spatial justice and critical spatial practice. Students then analysed media in different formats, including literature, theatre, and film, allowing students to inhabit lived experiences through character personas while providing critical distance. Lastly, students conducted embodied site research through critical walking to gain eye-level sensory

experience. Design responses addressed documented practices: avoiding inhabitants' sleeping spaces, enhancing gathering and resting spots, and programming for women and children in male-dominated public spaces.

The second project proposed adaptive reuse of vacant colonial farm outbuildings within a house museum complex as a centre for indigenous botanical knowledge. Students studied adaptive reuse theory, consulted with experts, and observed spatial practices during site visits to the National Herbarium, urban food gardens, and museums. Designs demonstrated heritage sensitivity while proposing programmes informed by knowledge exchange and documented use practices.

The third project required integrative literature reviews to define spatial practice, establish theoretical frameworks, and identify ethically viable methods for analysing spatial practice. Students analysed distinct contexts: masaajid (mosques) revealed Muslim communities adapting standardised typologies; assistance dog training centres uncovered tacit knowledge about how visually impaired persons navigate through multisensory engagement; birth spaces examined intersections of institutional protocols, physiological processes, and personal experiences. Students applied insights as design informants, bridging gaps between regulations, design intentions, actual use, and experiences.

Through a systematic investigation of spatial practice, students develop empathy for users whose needs often remain invisible in conventional programming,[67] thereby accessing the tacit knowledge that users develop through everyday spatial interactions. Assessment revealed shifts from aesthetic-focused approaches to experience- and user-centred design, informed by observed spatial practices.

While these methods are not new, their systematic integration to investigate spatial practice and inform design decisions is innovative, particularly in contexts where ethical, temporal, or access constraints prevent direct engagement and more intrusive research methods.

CONCLUSION

This research contributes to establishing circular knowledge loops, where space use informs future design, extending lifecycles and reducing extractive demolition-reconstruction cycles. This approach enables adaptive reuse and spatial reprogramming, particularly valuable in resource-limited settings, advancing more responsive architecture that recognises the entanglement of space, practice, and human experience.

The pedagogical framework presented here demonstrates that spatial practice represents underutilised design intelligence. By revaluing user knowledge as legitimate design content, architectural education can bridge the persistent gap between intended outcomes and actual experiences, ultimately leading to more responsive and sustainable institutional architecture.

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DESIGNING BEYOND-R: AN ALTERNATIVE DESIGN APPROACH IN THE TIME OF CLIMATE EMERGENCY

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INTRODUCTION

Controlling interior climate through the R-value has been a common solution in the U.S, especially since the energy crisis of the 1970s. Since then, the R-value has been used as an indicator of energy efficiency, and it is assumed that a higher R-value equates to a more sustainable building.[1] The R-value, the reciprocal of the U-value, is calculated by summing the product of thermal resistivity and material thickness, plus the resistance of air films on both sides of the wall. Through a high R-value envelope, a building can minimize heat gain when it is hot outside and minimize heat loss when it is cold outside, based on Fourier's Law ($Q = kA\Delta T/L$) and the Second Law of Thermodynamics. With advances in building technology, we can now achieve high R-values not only in opaque walls but also in glazed vision glass, with vacuum glass achieving beyond R-20, comparable to a solid wall.[2] These envelopes perform even better when they are structurally detached from the interior to reduce thermal bridging. This isolative method has been effective as an overarching solution across the states and has been applied in any climate or pattern. Nationally, building codes prescribe minimum R-values for each climate zone, and, to achieve higher energy efficiency, many states' new energy codes now require up to 58% more insulation in their building envelope than 12 years ago.[3]

Since R-value-based energy conservation practices focus on efficiently insulating the interior from the exterior, just like an icebox, their central focus of research has naturally been the interface between the interior and exterior: the wall itself. While there has been significant progress in building science on thermal behavior within the wall assembly, this isolated approach inadvertently dismisses what surrounds the wall—separating itself from the external climate and the interior volume, from its ambient energetic fields and the inherent heat capacity, decoupling itself from the real, lived condition. Furthermore, with the dismissal of the external ambient field, the only means of maintaining indoor comfort has become active systems powered by fossil fuels or mineral extraction; thus, ironically, the strategy to achieve greater sustainability results in the building's further reliance on extractive, unsustainable practices, which have not shown their effectiveness at reducing total energy throughput. (Figure 1.)

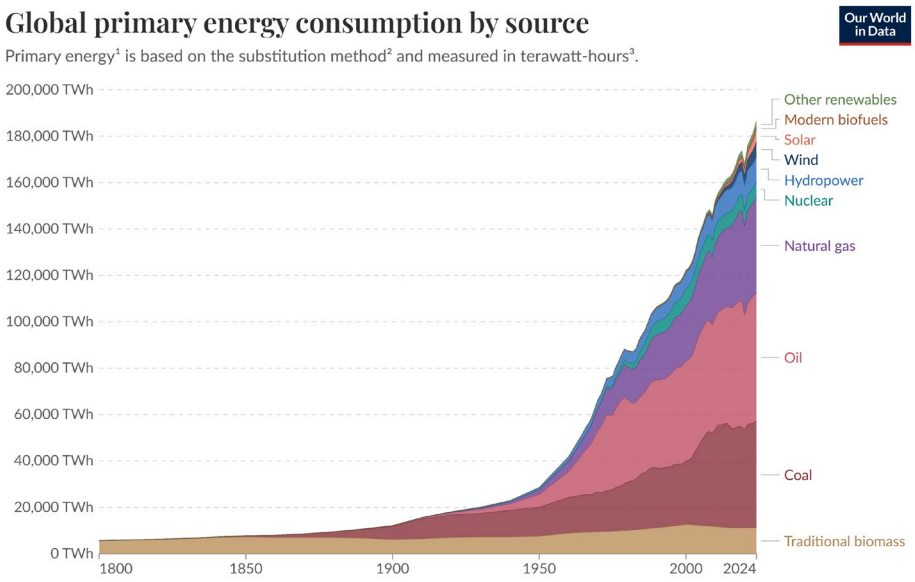


Figure 1. Global primary energy consumption by source.[4]

Current trends in R-value-based isolative U.S. residential development are exemplified by construction documents whose nomenclature in the drawing set calls out the street-facing façade as the 'front' elevation, rather than referencing it as the ‘north,’ or ‘south’ elevation (Figure 2.) This nomenclature allows developers to replicate identical structures along a roadway using a single drawing set, irrespective of the building's actual cardinal orientation. Consequently, some buildings may be well oriented to the climate, while others might not be, revealing the problematic symptom of an isolating approach that dismisses not only their external energetic patterns but also their interior organizational and spatial responses to them. (Figure 3.)

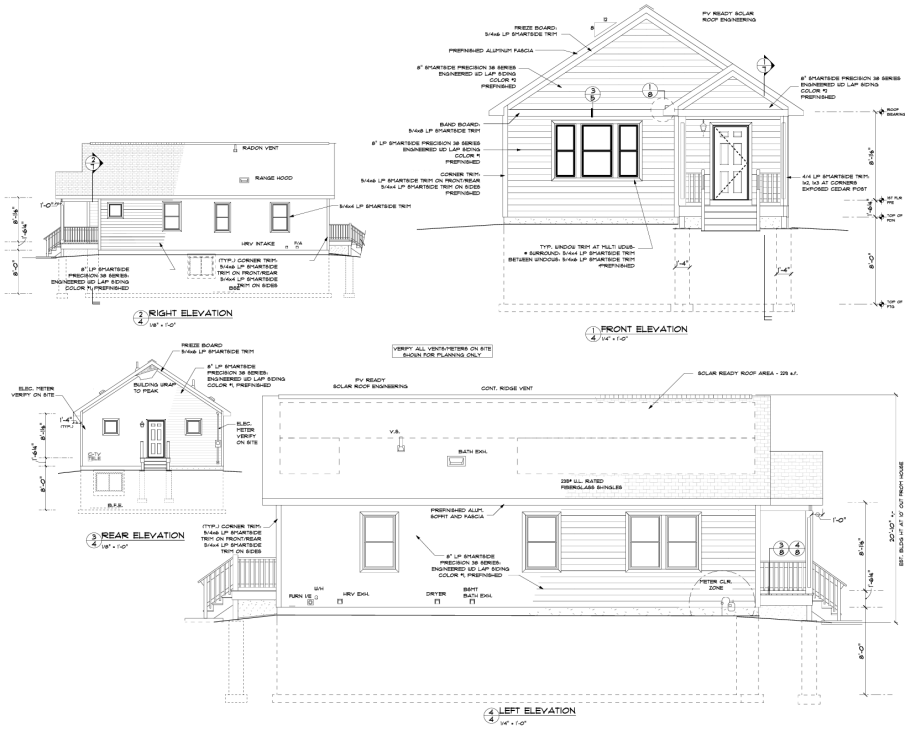


Figure 2. Elevation Drawing, 6310 Irving Ave, Richfield, MN, Habitat for Humanity

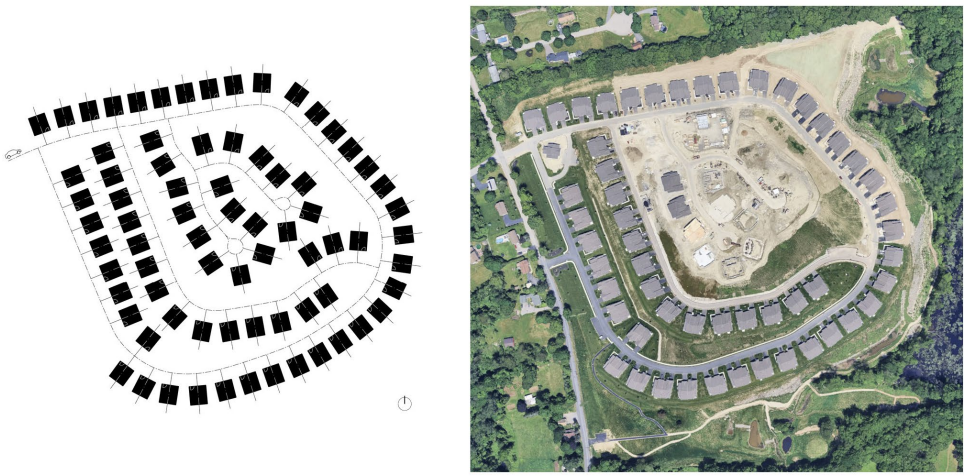


Figure 3. Residential Development, 1 Clearview Terrace, MA

As building designs that respond to the peculiarities and inconsistencies of the actual site have been lost, the appearance of the building has become similar regardless of its macro- and micro-climatic patterns.[5] In contrast to the vernacular buildings that produced unique spatial expression by creatively responding to their unique climate pattern, it has been hard to distinguish the buildings being developed in Chicago from the new buildings being constructed in Texas. And as isolation through high R-value has become the predominant and seemingly the most effective response to the climate urgency, 'architectural' design and 'spatial' experiments now feel anachronistic, a luxury of the past, losing meaning, especially for students with high climate consciousness. Thus, we are living in the time of the climate crisis, and at the same time, we may be experiencing an architectural design crisis as well.

This raises important questions: "What is the architectural agenda in the time of the climate crisis?" "How do we justify and teach spatial practice during the climate emergency?" "How can spatial practice and its pedagogy contribute to reducing total energy throughput?" and "Can technological and spatial practice entangle again to achieve greater sustainability?"

LIMITATION OF R-VALUE

To find an alternative approach to respond to the climate crisis, we first need to understand how R-value is produced, what its limitation is, how it has disconnected us from reality, and what other opportunities we have been missing.

Lab condition vs. Real-world condition

R-value is determined under laboratory conditions using ASTM C518, the Standard Test Method by Means of the Heat Flow Meter Apparatus. In this test, a flat sample (typically WxL=1'x1') is sandwiched between a hot plate and a cold plate, and sensors measure the rate of heat flow and the temperature gradient across the sample.[6] During this test, the R-value is measured only when the apparatus registers a constant heat flow rate, indicating thermal equilibrium, and steady-state conditions are met. To achieve this, the plates' temperatures must be maintained without fluctuation for a considerable period. (Figure 4.)

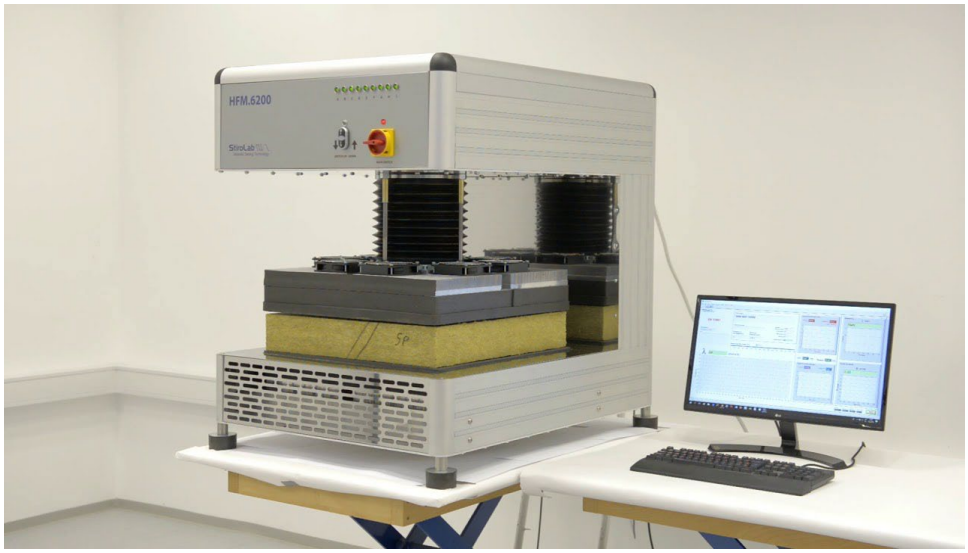


Figure 4. ASTM C518, Heat Flow Meter System.[7]

This shows that the R-value measuring method does not reflect the dynamic conditions of real-world, where temperatures fluctuate constantly throughout the day and seasons. In real life, the thermal gradient within a wall rarely achieves the stable profile observed in the Heat Flow Meter test. If R-value can only be measured under steady-state lab conditions, using its outcome to the real-life which are very dissimilar to its tested condition, raises a concern about the legitimacy of using the R-value as a metric for the wall's thermal efficiency.

Partial heat transfer mode

Also, heat transfer occurs in multiple modes—conduction, convection, radiation, and evaporation—and, depending on the region, certain modes of heat transfer become stronger than others. In many cases, the perceived temperature through different modes of heat transfer is assumed 50% conduction and 50% radiation when convection and evaporation are negligible,[8] and evaporation often becomes the most potent interior comfort regulating mode in dry-hot climate zones. Thus, the oversimplification of heat transfer behavior using conduction-based R-value alone captures only a fraction of the heat transfer and risks overlooking other behaviors that can significantly affect a space's actual heat transfer.

Time factor

Probably R-value's biggest disconnect from reality is its exclusion of the time factor. To measure R-value in a steady state, each test can take hours or even days to achieve a stable gradient, depending on the material's properties.[9] This shows the dismissal of the time factor during the test procedure, which reveals its discrepancy from reality. Instead of only using conductivity (k) as a sole variable of material heat behavior, by including density (ρ) and specific heat (C_p), we can incorporate a 'time factor' where we can understand how a building responds to the fluctuation of its ambient condition. Calculating diffusivity ($\alpha, k/\rho C_p$) as well as total heat capacity ($\rho C_p V$) through expanded thermal parameters helps us understand the speed of heat transfer, its duration, and the hat capacity of building assembly to offset thermal fluctuations over a given time period.

ALTERNATIVE APPROACH

Contrary to the modern, isolated, and narrowly focused approaches, vernacular architecture has self-adapted its form, materials, and spatial organization in response to its real climate conditions. Without prioritizing certain modes of heat transfer—and without an obsession with rejecting energetic flow—vernacular precedents optimized and configured their space and materials to best fit their dynamic climate conditions through iterative processes. Often, these approaches strongly couple with their actual surroundings and actively absorb and utilize abundant energy fields rather than merely isolating from them, producing unique spatial responses that embody hundreds or thousands of years of spatial intelligence. Many of these strategies still work, and the buildings remain occupied by residents.

Vernacular example 01: Radiation as spatial organization strategy

The Samuel Hartwell House in Lincoln, Massachusetts, U.S., locates a high thermal ($\rho C_p L$) and low diffusivity ($k/\rho C_p$) fireplace at the center of the house that spans multiple stories. (Figure 5.) Using wood as a fuel for daytime heating and cooking, the stored heat energy through high volumetric heat capacity provided radiant heating across the house, and with low diffusivity it were able to slowly release the heat energy throughout the night even when there was no active fire, which was a very effective way to heat the space in a building with high ACH (Air Changes per Hour) due to envelope air leakage and stack effect due to the chimney. The interior room layout was organized around the heat source on each side of the chimney to maximize the benefit from radiation. Through this material selection, spatial organization, and coordination with occupants' behavior, the building provided the maximum possible comfort given the technology, materials, and active system choice of its time.

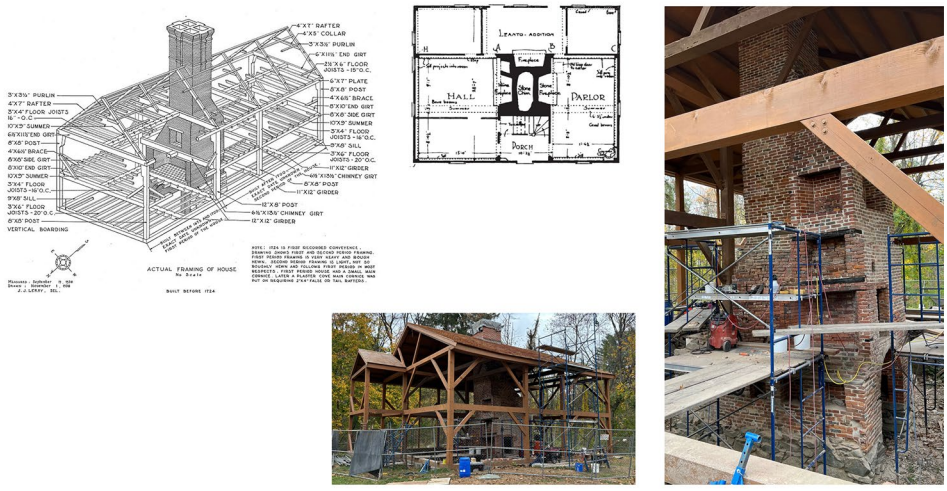


Figure 5. Samuel Hartwell House, Lincoln, Massachusetts, U.S (1690s)

Vernacular example 02: Mix of absorption and rejection

Also, some vernacular examples strategically reject and absorb ambient energy by responding to seasonal patterns through placing components with different material capacities in different parts of the house. The Acoma Pueblo in New Mexico responds to the different solar altitudes during winter and summer through its ingenious material strategy. (Figure 6.) Low conductivity (k) wood joists at the ceiling reduce heat ingress during summer when the sun's altitude is high, meanwhile, the high thermal mass and low thermal diffusivity of the vertical walls increase solar energy absorption during winter when the sun's altitude is low, storing solar radiation energy and releasing the energy to the

interior during the night. By coupling seasonal and daily climate patterns with comprehensive material thermal properties and occupant behavior patterns, this house strategically maximizes the use of beneficial ambient energy.



Figure 6. Acoma Pueblo, New Mexico, U.S[10]

Vernacular example 03: Emissivity

Emissivity (ε) is another factor that is well incorporated in vernacular architecture. Emissivity impacts how much radiative heat exchange occurs between two objects (Stefan-Boltzmann equation: $\sigma\varepsilon A(T_2^4 - T_1^4)$). White, smooth surfaces have lower emissivity, leading to lower heat transfer, while dark, rough surfaces have higher emissivity, leading to higher heat transfer. In the houses of Santorini, residents apply new white plaster just before Easter.[11] With this fresh and smooth white finish with low emissivity, they effectively reject the pouring sunlight during the hot summer. And as the surface becomes dusty and rough as summer turns to winter, its higher emissivity helps absorb heat, providing comfort in the colder season.[12]



Figure 7. Traditional Santorini Architecture

INTEGRATION OF NEW TECHNOLOGIES AND DATASETS

One of the reasons we have solely focused on R-value for the last many decades is due to R-value's simplicity of calculation, linearity, and its straightforwardness. Utilizing Fourier's Law ($Q = kA\Delta T/L$), where the k value can be found easily from books and the internet, calculating Heat flow (Q) of a wall can be swiftly done using a pen and paper. Many energy calculation software further simplify the process and enable more accurate calculations by accounting for thermal bridging from stud placements. However, calculating comprehensive heat transfer using either an analytic or a numerical method is nearly impossible due to its complexity as well as the extensive amount of calculations that are required. The analytic calculation of the radiation view factor (Figure 8.), which is only a portion of the radiation heat transfer calculation, clearly shows the complex nature of the analytic method. The view factor equation is used only between two surfaces, and adding more surfaces to account for various surfaces within the room, as well as accounting for convection and conduction, will further add complexity, showing the difficulty of integrating comprehensive heat transfer into the building design process.

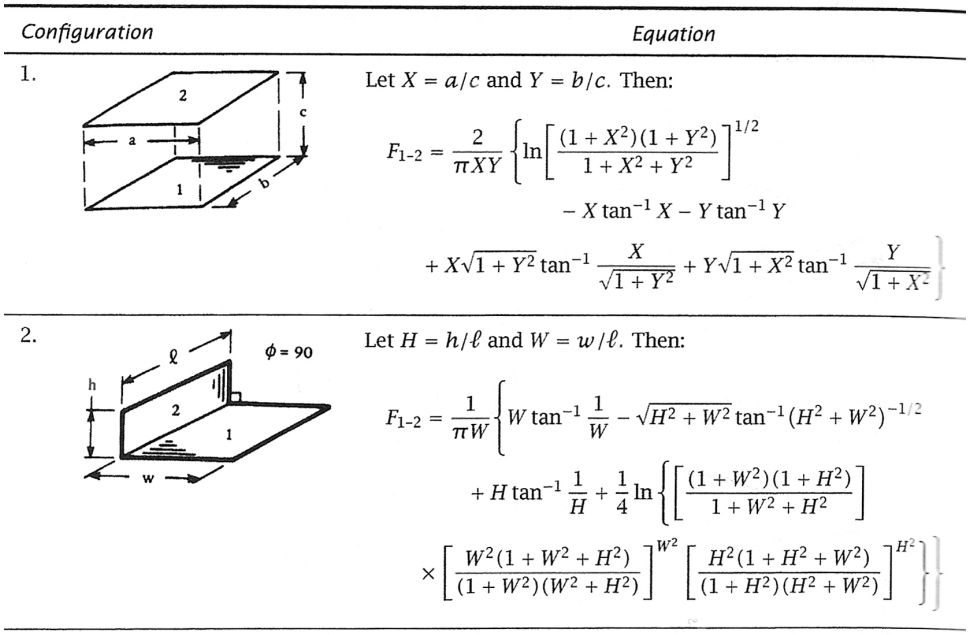


Figure 8. Radiation View factor for three-dimensional configurations.[13]

But with advances in technology, these difficulties are starting to be resolved. Although reflecting all the variables of actual conditions is impossible, we can incorporate as many factors as possible to better resemble lived conditions through advanced simulation analysis and accumulated weather data. Instead of relying on rules-of-thumb and general knowledge about how to respond to broader climate zones, we can use emerging cloud computing power to process complex, comprehensive heat-transfer modes while referencing specific datasets to better understand actual climate patterns in an exact region. With this comprehensive understanding—and where the exhaustion of calculation is transferred to the computer, and where a specific data set replaces generic knowledge on their climate—we can use the enhanced processing power as an opportunity to produce spatial design strategies and verify the building's thermal behavior under virtual conditions that closely resemble the actual conditions.

Advanced CHT Simulation

The advanced simulations utilize Conjugate Heat Transfer (CHT) that is powered by cloud-based computing. Through this, we are able to calculate and visualize the heat flux where solid and fluid are thermally coupled, which means we can calculate radiation, conduction, and convection through a personal PC. This software is equipped with the ability to input extended material thermal parameters, including density, conductivity, and specific heat. This allows for processing the diffusivity and heat capacity of the material into the simulation, where we can understand the time-based dynamic behavior of the building.

Advanced CHT simulation is also equipped to calculate fluid density with its temperature and humidity change. This enables the prediction of the buoyancy effect within the volume, which is crucial for understanding the passive power of the building through, such as solar chimney or stack effect. For instance, we can design a massing form that is formed to generate the strongest solar chimney effect at a specific site at a given time, predict the speed of air movement, and analyze passive cooling capacity through the solar chimney effect in a single workflow. (Figure 9.)

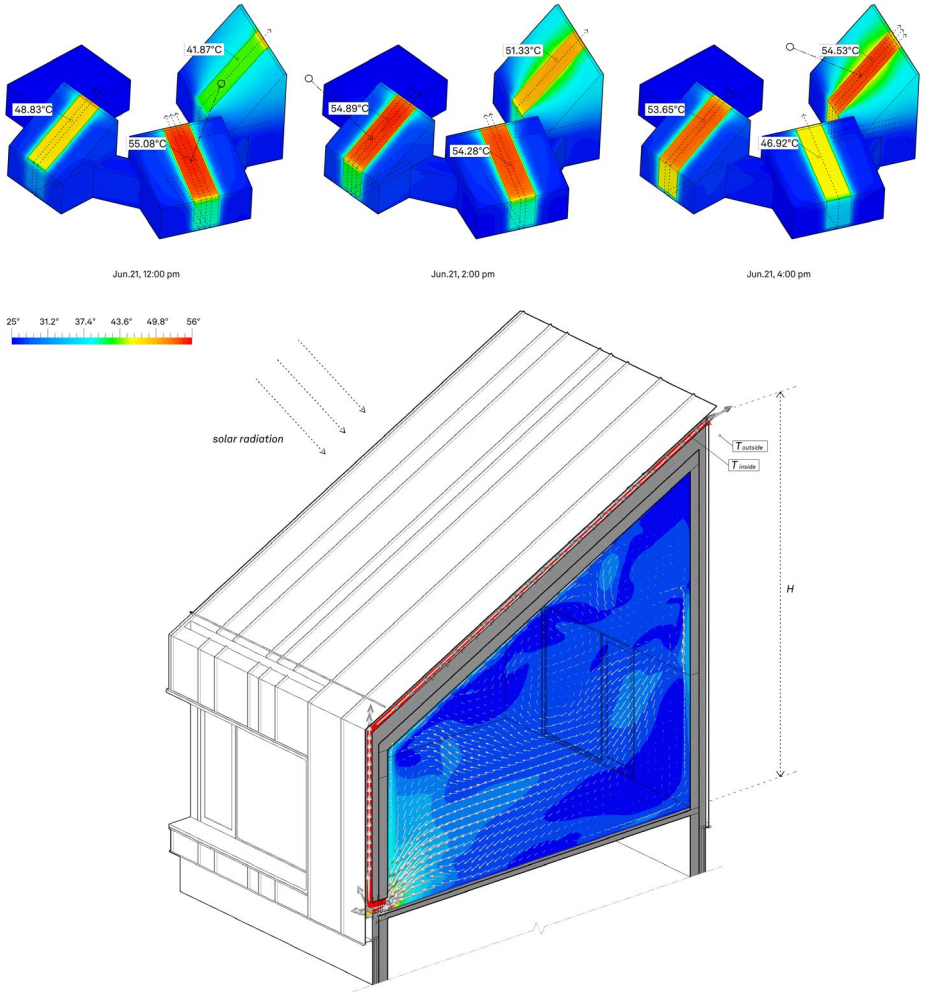


Figure 9. Solar chimney effect analysis

When all these thermal aspects are combined, we start to see that thermal conditions within a single thermal zone can significantly vary. (Figure 10.) This brings a different understanding of an interior thermal condition, where traditionally, each room is typically perceived as a single homogeneous

thermal zone. Through the help of advanced technology, we can understand and visualize space, not as a static zone where its ambient energy remains in equilibrium, but as a dynamic zone where fluid continuously moves and energetic exchanges are constantly occurring.

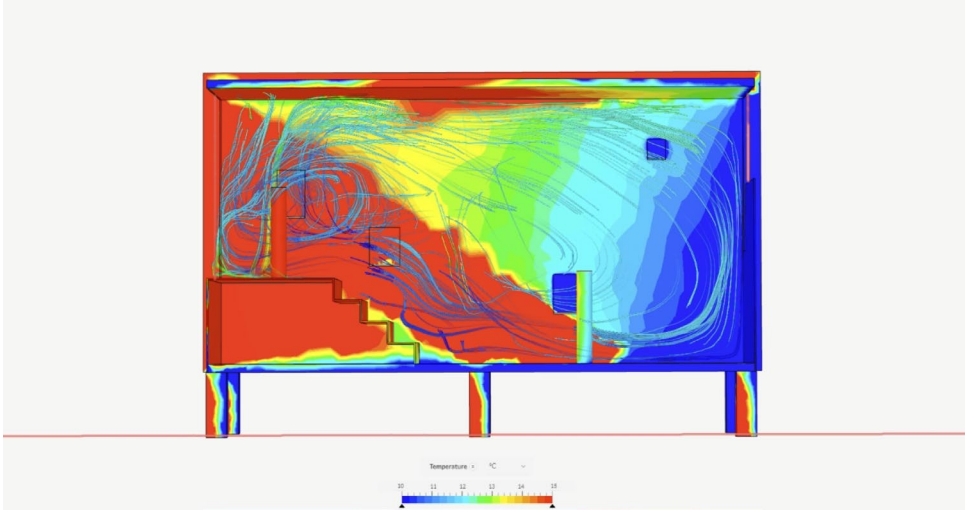


Figure 10. Comprehensive CHT simulation

Weather dataset

Along with advances in processing power, we have accumulated weather data for each region and can access comprehensive weather data across the world with a few clicks. Weather datasets from over 16,000 weather stations worldwide measure conditions 8,760 times a year, recording climate conditions including dry-bulb, wet-bulb, solar irradiation, humidity, cloud coverage, and wind speed and direction throughout the year.[14] This provides specific information that can be crucial in finding the best passive strategy for a specific site, especially for designers who develop a project at a remote site. This enables the close incorporation of actual micro-climate conditions, allowing designers to experiment with bioclimatic spatial strategies that would be best suited to each region.

CONCLUSION: AN ALTERNATIVE DESIGN PEDAGOGY

This alternative approach, using advanced simulation and comprehensive datasets that integrate spatial design with actual climate conditions, links the architectural process directly to dynamic ambient conditions and comprehensive thermal behavior. This non-isolating and dynamic approach, in which the architectural form and its material strategy function as a climate-regulatory device by being closely coupled to its environment, will provide a sustainable 'spatial' design methodology during the climate crisis, offering a powerful pedagogical opportunity. By moving beyond the R-value, students can seek spatial design responses that can passively store, transport, and exchange energy within their dynamic field. To achieve this, their designed space must extend, exaggerate, stagger, and thicken, thus produce differentiated spatial volumes and interior experiences.

By understanding that thermal behavior is never steady-state, and with the help of advanced cloud-based simulation that processes this dynamic condition, and with the ability to access the dataset world-wide, students will be able to design and verify their spatial strategies from their studio desks, generating solutions that are sustainable and architecturally rich in their expression. This shift of focus from the wall itself to spatial design, from lab conditions to real-world patterns, will link design pedagogy to urgent real-world issues, promote comfort for both occupants and the planet, and produce a novel form that responds to the distinct characteristics of each region.

NOTES

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TRANSLATING ENERGY SYSTEMS INTO POLICY UNDERSTANDING: INCLUSIVE STRATEGIES FOR INTERDISCIPLINARY LEARNING ON CLIMATE CHANGE

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INTRODUCTION

Climate change is frequently described as a wicked problem because it involves incomplete, contradictory and variable requirements that are often difficult to recognise. The transition from a fossil-fuel dependent economy to one powered by sustainable energy sources constitutes the defining technical and social challenge of the 21st century. However, the educational structures designed to prepare professionals for this transition remain largely fragmented. Traditionally, energy education is divided into different subdisciplines. More specifically, engineering programmes focus on the physical and mathematical how (e.g. thermodynamics of heat pumps, aerodynamics of wind turbines and the electrical engineering of grid balancing) while social sciences and humanities programmes focus on the regulatory, ethical and economic aspects, including the Paris Agreement, public perceptions of renewable energy technologies and the economics of carbon pricing. This separation creates a significant knowledge-action gap where engineers may design technically competent solutions that later fail due to social rejection.

At the same time, policymakers might draft ambitious decarbonisation targets that fail because they do not fully grasp the underlying technical bottlenecks and system constraints, such as grid capacity, materials and land requirements. This paper addresses the pedagogical friction between the two worlds by drawing upon a comprehensive case study of *the Energy & Climate Change* MSc module (Level 7 FHEQ) delivered at Birkbeck, University of London, UK over the summer of 2025. The module's primary objective was to introduce the principles of sustainable energy technologies to a non-specialist audience, enabling them to critically assess environmental impacts and policy frameworks.

C.P. Snow’s influential 1959 lecture, The Two Cultures, criticised the intellectual divide between the sciences and the humanities.[1] Sixty years later, this divide persists in higher education, particularly in the area of energy. Students entering the Birkbeck module often brought with them disciplinary constraints which occur as a self-perceived inability to engage with quantitative data or technical diagrams. On the other hand, they possessed strong skills in careful reasoning, analysing language and thinking about how social systems and structures work.

From the educator’s point of view, the challenge was to facilitate a paradigm shift in the students' self-conception, transforming them from passive recipients of technical advice into professionals who actively question and test the technical evidence. This required a fundamental rethinking of how

engineering concepts are taught, moving away from the deductive approach typical of STEM education towards an inductive and authentic approach where real-world problems drive the need for technical understanding.[2] To highlight the specific strategies required for a non-specialist audience, this report compares the Birkbeck experience with parallel teaching of engineering students at the New Model Institute for Technology and Engineering (NMITE), Hereford, UK. At NMITE, the pedagogical model is designed to support the "new engineer", a professional who is creative, practical and socially aware. The curriculum utilises Problem-Based Learning (PBL) and often follows the engineering V-model to scaffold technical design tasks. Students act as creators who model, simulate and build either physical or digital artefacts.[3] At Birkbeck, students operate as evaluators and project managers rather than technical designers, focusing on questions of location, funding and delivery rather than engineering the turbine itself. This distinction between the creator and the critic shapes the pedagogical strategies that must be adopted.

THEORETICAL FRAMEWORK

To navigate the complexities of teaching across disciplines, several theoretical frameworks are considered: Signature Pedagogies, threshold concepts, Universal Design for Learning (UDL) and constructive alignment. Lee Shulman introduced the concept of signature pedagogies to describe the characteristic forms of teaching and learning that define a profession. These pedagogies do not just teach knowledge; they socialise students into the field's "habits of mind".[4] A brief comparison between engineering and social sciences, in terms of their signature pedagogies, can be seen in Table 1.

Feature	Engineering Signature Pedagogy	Social Sciences/Policy Signature Pedagogy
Epistemology	Knowledge is established through measurement, modelling and empirical verification.	Knowledge is constructed through interpretation, argumentation and contextual analysis.
Deep structure	Quantitative modelling and optimisation to reduce uncertainty.	Critical analysis of ambiguity, values and trade-offs.
Surface structure	Problems, lab reports, design studios and simulations (e.g. Excel, CAD).	Seminars, essays, debates, policy briefs and case studies.
Implicit values	Efficiency, feasibility, safety and optimisation.	Equity, justice, legitimacy and social impact.
Pedagogical goal	To produce a functional, verifiable solution (the artefact).	To produce a robust, defensible argument (the critique).

Table 1. Disciplinary differences in signature pedagogies

The friction in the Birkbeck module took place when the content of engineering collided with the social sciences' habits of mind. Engineering concepts are taught using the signature pedagogy of engineering, such as the derivation of equations. When this approach is applied to social science students, it often results in cognitive overload and disengagement. Therefore, the pedagogical challenge was to translate the content of engineering into the signature pedagogy of policy by replacing calculations with conceptualisation.

Furthermore, Meyer and Land defined threshold concepts as core ideas that are transformative, irreversible and integrative but often troublesome for learners.[5] In energy education, several concepts act as thresholds that non-specialists must cross to achieve literacy. Thermodynamic constraints

constitute the first concept, the realisation that energy transformation is never 100% efficient and that waste heat is inevitable. For social scientists used to policy levers and narratives, thermodynamics introduces constraints that can challenge their underlying assumptions about how the world works. Secondly, the distinction between energy intermittency and dispatchability is of paramount importance, understanding that renewable energy is stochastic and cannot be turned on like a natural gas power plant. This challenges the assumption that decarbonising the electrical grid is simply a matter of replacing older technologies with new sustainable systems. Finally, the energy trilemma highlights that energy security, sustainability and affordability can be difficult to achieve at the same time. Improving one dimension of the triangle often comes at the expense of the others, encouraging a transition from solutionist thinking to an appreciation of trade-offs.

Universal Design for Learning (UDL) is a framework for optimising teaching by providing multiple means of engagement, representation and action or expression.[6] It is particularly relevant for disciplinary inclusion, ensuring that students from non-STEM backgrounds can access STEM content without being marginalised by their lack of prerequisite knowledge. Engagement (Principle 1) focuses on connecting learning to students' interests. For the Birkbeck cohort, this meant framing technical problems as social justice challenges such as energy poverty. Representation (Principle 2) involves presenting information in multiple ways; instead of relying solely on equations, the module utilised videos, analogies and interactive tools. Finally, expression (Principle 3) allows students to demonstrate knowledge through diverse formats such as presentations, debates and blogs rather than just exams.

Biggs suggested that effective teaching requires alignment between the Intended Learning Outcomes (ILOs), the teaching and learning activities (TLAs) and the assessment tasks (ATs), known as the principle of constructive alignment.[7] In the context of the Birkbeck module, realigning these elements to ensure that seminar activities practised the skills required for the assessment became a central focus of the pedagogical intervention.

PEDAGOGICAL CONTEXT AND CHALLENGES

The "New Engineer" at NMITE: A baseline for comparison

To understand the specific needs of the Birkbeck cohort, it is useful to establish the baseline of engineering education at NMITE. The NMITE Foundation Year module, Problem-solving in engineering, focuses on the development of the "New Engineer" and its pedagogy is based on PBL. Students are given a user requirement specification (URS) to design an energy systems solution for a 2-bedroom flat in Birmingham. They use the Engineering V-Model (Verification and Validation) to define requirements, design the system, model it in Excel and verify the outputs.[8] The focus is on inductive learning; students realise they do not know how a battery works so they research the specifications of different commercial systems to solve the specific problem of "how many hours can this battery run the heat pump?". The key skills involved are verbalisation and visualisation (Ve&Vi), listing assumptions and conducting basic technical modelling. Here, the technical knowledge is the means to a design end as the students are makers.[9]

The "Policy Professional" at Birkbeck: The challenge of translation

The Birkbeck *Energy & Climate Change* module operates in a different pedagogical universe. The students are mature professionals who are often working full-time. They are not makers but managers and advocates. The cohort included students with degrees in history, politics and arts. Many had not engaged with physics or mathematics since completing their GCSEs. This contributed to reduced academic confidence, with students feeling marginalised within technical conversations.

A significant challenge identified during the module was the language barrier and the ontology of energy. While engineering students are comfortable treating energy as a physical quantity measured in Joules (J) or kilowatt-hours (kWh), social science students primarily encounter energy as a commodity, a geopolitical weapon or a social right. When the syllabus turned to technical specifics, such as the difference between power (kW) and energy (kWh), they struggled to conceptualise the invisible flows of the system. This gap led to confusion during the early seminars of the module; students could debate the ethics of a wind farm but initially struggled to understand why a 10 MW wind farm does not consistently operate at its rated capacity, even under favourable wind conditions. It was recognised that their practice initially remained at Stage 3 of Kugel's development model, emphasising content delivery rather than supporting students' conceptual restructuring.[10] It became apparent that clear technical presentation alone did not reliably lead to understanding, prompting the adoption of analogies and visualisations to integrate theoretical reasoning with practical intuition.

CASE STUDY: THE ENERGY & CLIMATE CHANGE MODULE

The response to these challenges involved a comprehensive redesign of the module's seminars, resources and learning activities. This section details the specific interventions and maps them to the theoretical framework.

Demystifying technology through Bridging Analogies

A central principle of UDL is providing multiple means of representation.[11] For non-specialists, the mathematical description of energy systems is often a barrier. To overcome this, bridging analogies were employed to connect abstract concepts to familiar experiences. One of the most complex topics in the syllabus was Energy Storage and the role of hydropower. Engineering students typically analyse Pumped Hydro Storage (PHS) using the equation $p = \rho g h V$. For the Birkbeck cohort, this equation was replaced with a functional analogy: the "AA rechargeable battery" of the grid.

Students viewed side-by-side figures of a battery schematic and a reservoir system to understand the concepts of energy arbitrage (buying low, selling high) and energy storage duration. This analogy enabled students to understand both the functional logic of pumped hydropower and the concept of round-trip efficiency, without requiring formal calculations of hydraulic head. This facilitated policy discussions, such as "If PHS is just a big battery, why don't we build more?" which naturally led to discussions on geography and planning permissions (NIMBYism) that aligned with their social science strengths. Similarly, to explain grid inertia and the electrical grid's balance of supply and demand, the bathtub analogy was used. Grid frequency was represented as the water level, generation as the tap and demand as the drain. This visual model helped students see why operating a grid with very high shares of renewables requires substantial system flexibility, including storage, thereby shifting discussion from normative preferences towards technical feasibility.

From passive lectures to active communities of practice

Active learning strategies were deployed to shift students from passive listeners to active participants. This was crucial for overcoming the imposter syndrome many felt regarding technical topics. For instance, in Week 6, a role-playing simulation was introduced to replace a standard seminar discussion. Students were divided into groups representing a "Community Energy Council" for a fictional town. They were given a fixed budget, a carbon reduction target and a specific geographical profile; no complex modelling software was used. Their decisions were scored with three main metrics: cost (CAPEX), carbon output and reliability rating.

The task was to select a mix of technologies to meet the town's demand while satisfying the budget and carbon constraints. The exercise was deliberately structured to highlight trade-offs. A strategy

relying solely on wind power, for example, led to a lower reliability score and a greater risk of power interruptions. On the other hand, selecting biomass to improve reliability prompted simulated local opposition over air quality, introduced by the instructor. In this way, the activity modelled the practical challenge of balancing the energy trilemma. Students engaged in sociotechnical reasoning, debating not just the associated costs but the social acceptability of biomass versus the visual impact of wind turbines. This moved students from conceptual discussion to making situated decisions under real-world constraints.

Visualising the intangible: The Global Wind Atlas

A specific intervention was introduced to address the spatial dynamics challenge identified in the syllabus (Week 3). Engineering students typically learn to calculate wind potential using wind speed data and the Betz limit formula. For the Birkbeck cohort, this mathematical abstraction was replaced with geospatial visualisation using the Global Wind Atlas, an open-source web-based tool.[12]

During the seminar on Wind Energy, students were not asked to derive power curves. Instead, they assumed the role of energy developers, evaluating and selecting appropriate locations for deployment. They used the Atlas to visually explore wind power density (W/m^2) across different terrains, observing how wind speeds increase offshore or in highland areas. This tool effectively de-black-boxed the concept of resource assessment. Students could actually see why offshore wind is more efficient but also immediately recognised the spatial conflicts with shipping lanes or marine protected areas. This intervention aligned perfectly with UDL Principle 2 (representation) by converting numerical data into a visual heatmap. It allowed students to perform high-level site assessment and critique government targets (e.g. “Why is the UK targeting 50 GW of offshore wind?”) based on evidence rather than rhetoric. It bridged the gap between the resource’s physical characteristics and the political constraints of land-use planning.

Authentic assessment: The MacKay Carbon Calculator

The first assignment of the module required students to produce an energy decarbonisation pathway. This is an example of authentic assessment, a task that mirrors the real-world work of policy advisors. The tool used was the MacKay Carbon Calculator, developed by the UK Department for Energy Security and Net Zero.[13] Students manipulated levers (e.g. insulation, offshore wind capacity) to create a pathway that meets the UK's 2050 net zero target. The tool performs the underlying calculations, such as balancing supply and demand, allowing students to focus on the implications. For example, when “Level 4 Bioenergy” was selected, the appropriate land use requirements had to be acknowledged. Similarly, if “Level 4 Nuclear” was selected, students had to acknowledge the extended lead times and construction schedules involved. The tool black-boxes the engineering calculations while making policy trade-offs transparent, enabling non-engineers to engage with high-level systems reasoning.

DISCUSSION: BRIDGING THE TWO CULTURES

The sociotechnical sweet spot

The success of the Birkbeck module lies in its ability to find the sociotechnical sweet spot. Engineering education often treats the social aspect as an externality while social science education often manages the technical side as a black box.[14] By integrating the two, the module aimed to develop energy literacy, understood as an appreciation of energy’s fundamental nature and its significance in both the physical world and human society. For instance, when discussing wind energy, the curriculum moved beyond the Betz Limit (technical) to discuss the Global Wind Atlas

(geographical) and regulatory frameworks (political). This multidimensional approach validated the students' diverse backgrounds. More specifically, a student with a background in law could make a substantial contribution to discussion of permitting while a student with a background in economics could lead the discussion on Levelised Cost of Electricity (LCOE).

Scaffolding: Different strokes for different cohorts

Comparison with NMITE shows that scaffolding is context dependent. For NMITE engineering students, the aim is to support the creation of technical systems, so scaffolding focuses on problem scoping and constraining the context (for example, modelling a single house) in order to work with complex tools such as Excel and the V-model. For Birkbeck policy students, the aim is to support critique of technical systems, so scaffolding instead reduces tool complexity (for example, through online calculators and analogies) to enable engagement with complex, real-world contexts. In this setting, students' Zone of Proximal Development (ZPD), that is, the region where supported learning enables higher-order reasoning[15] lay less in performing the calculations and more in interpreting what the results implied for decisions and trade-offs.

Student feedback

Student feedback confirmed the effectiveness of these interventions. As a student later remarked, the module "did not require her to be an engineer" but helped her become a "more evidence-based policy thinker". The role-playing activities were cited as key to making "boring theories feel more real". Quantitatively, the module achieved a 100% positivity measure for "teaching staff explaining things", indicating that the use of analogies and videos, consistent with UDL strategies, supported students in overcoming key technical barriers. However, challenges remain as the current rubric provides a useful general framework but overall, it is quite broad. Dedicated effort should therefore be allocated to refine it so that it aligns more closely with the specific requirements and learning outcomes of the module. Finally, some students still continued to find the range of technical terms challenging.

CONCLUSIONS

The transition to a sustainable future requires a "New Engineer" who understands society but it equally requires a "New Policymaker" who understands physics and engineering systems. The Energy & Climate Change module at Birkbeck demonstrates that it is possible to teach advanced energy concepts to non-specialists without sacrificing conceptual depth; the key lies in the translation. By replacing equations with bridging analogies, passive lectures with authentic assessments, debates and the use of visual tools like the Global Wind Atlas, educators can empower arts and humanities graduates to become competent and confident stakeholders in the energy transition.

Educators can apply UDL by using analogies to make abstract concepts more approachable and can enhance assessment authenticity by using tools such as the MacKay Carbon Calculator to simulate real or realistic policy decision-making. Furthermore, active simulation, such as role-play, forces students to experience the trade-offs of the energy trilemma rather than just memorising definitions.

As 2050 approaches, effective dialogue between engineers and policymakers will be central to achieving climate goals. Higher education must equip students with a shared language and interpretive tools to bridge these perspectives.

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RESILIENT LIVING, SITUATED LEARNING: URBAN KAMPONG PEDAGOGY AND DESIGN CHOICE IN TRANSNATIONAL DESIGN COURSES

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INTRODUCTION

Between 2024 and 2026, the School of Architecture, Planning, and Policy Development at Institut Teknologi Bandung (ITB) and the Faculty of Art and Design at ITB, together with LUCA School of Arts (LUCA) and KU Leuven, organized joint courses focused on climate change and housing as part of the Global Minds program. Bandung's kampong served as a living archive. In the context of urban Indonesia, a kampong refers to a densely populated residential neighbourhood that has developed independently and is integrated within the formal city. Kampongs typically consist of narrow alleys, gradually constructed houses, small shops, shared amenities, and strong social networks. While often facing infrastructure constraints, kampongs are not the same as slums; they are long-established urban communities that support daily life, informal economies, and adaptive living practices. Intercultural groups explored design, ethics, and responsibility together.

The program included two related courses. My Beautiful Catastrophe (MBC) was offered at LUCA as a six (6) European Credit Transfer and Accumulation System (ECTS) Collaborative Online International Learning (COIL) elective linking Belgium and Indonesia. Students examined climate complexity through creative and cultural inquiry. Atelier Sud at KU Leuven was a design elective focused on global-south perspectives, intercultural thinking, and social responsibility. At Institut Teknologi Bandung (ITB), the joint course was officially framed as a Special Topic course: Social Project, delivered as a 3-credit elective. In this joint effort, ten undergraduate and three master's buddy teams were formed; public exhibitions were held in June 2025 in Bandung, Indonesia, and Belgium.[1]

The term 'kampong pedagogy' describes an approach where everyday elements: narrow alleys, makeshift drains, improvised shops, and shared spaces, become part of the learning experience. Solutionism was not emphasized; instead, careful description, thoughtful discussion, and modest, suitable suggestions were prioritized. In the COIL art-design-architecture, the challenges and opportunities of working across different languages, time zones, and disciplines were highlighted as

learning tools. Misunderstandings were noted, agreements were updated, and project briefs were adjusted based on shared information among intercultural buddy teams. The exhibitions provided an opportunity for public reflection. They required participants to communicate both process and outcome, express ethical viewpoints, and create clear display methods, especially for audiences unfamiliar with kampong life. This approach strengthened accountability to the communities and partners involved.

From Critical to Situated and Intercultural Pedagogies

Paulo Freire's critical pedagogy introduced a dialogical approach to education, where students and teachers were viewed as co-investigators engaged in both action and reflection to promote humanization. This approach emphasized problem-posing education rather than the traditional 'banking model' of teaching, which focused on one-way transmission of knowledge. The goal was to center dialogue, conscientization, and praxis in educational settings marked by social differences and historical inequalities.

Donald Schöön's concept of reflective practice redefined professional competence in studio learning as 'knowing-in-action' and 'reflection-in-action. According to this perspective, design was seen as an ongoing conversation with situations and materials, allowing for reframing while acting. This epistemology aligns with the improvisational nature of kampong life. Jean Lave and Etienne Wenger positioned learning as a process of participation within communities of practice. They suggested that newcomers gradually become more involved through legitimate peripheral participation. This idea was applied to intercultural collaboration in buddy teams, which were seen as evolving communities with their own norms and artifacts.

Darla Deardorff's competence models provided a framework for understanding the outcomes of intercultural learning. These models outlined attitudes such as respect, openness, and curiosity; knowledge, including self-awareness, culturally specific knowledge, and sociolinguistic knowledge; and observing, listening, and interpreting. These elements were connected to internal outcomes like adaptability and empathy, as well as external outcomes like appropriate and effective behavior. The movement from ethnocentrism to ethno-relativism was explained through Milton Bennett's Developmental Model of Intercultural Sensitivity (DMIS), which served as a guide for fostering growth in mixed teams.

The application of these theories to course design was facilitated, for instance, by Collaborative Online International Learning (COIL), as defined by the State University of New York (SUNY) COIL Center. COIL involved course-embedded, project-based, and interculturally focused learning experiences. These courses emphasized team building, comparative exchange, project co-creation, and presentation, all supported by reflection.[2]

CONTEXT AND STATISTICS: INDONESIA, BANDUNG, AND URBANIZATION

Urban development in Indonesia was noted in 2024, with approximately 59% of the population classified as urban, according to the United Nations Department of Economic and Social Affairs (UN DESA) World Urbanization Prospects (WUP) and the consolidated indicators from the World Bank. Under these circumstances, the pressure on land, infrastructure, and education increased, underscoring the need for self-help housing solutions.[3]

In Bandung, these trends were confirmed by official data in 2024, indicating that around 2.59 million residents were reported by Indonesia Central Statistical Bureau, with an average density exceeding 15,000 individuals per square kilometer, and some areas surpassing 20,000 individuals per square kilometer.[4] With these high densities, issues related to mobility, service provision, and risk exposure

became more pronounced, necessitating micro-scale assessments of daily transactions. An added layer of environmental risk was presented by the Intergovernmental Panel on Climate Change (IPCC) 6th Assessment Report Working Group II (WGII), which identified Asian cities as hotspots for extreme heat, heavy rainfall, and flooding; the Urban Policy Framework reinforced these messages for local authorities.[5]

For Bandung, recommendations for waste management amid heavy rainfall were thus emphasized. Long-term shifts in rainfall records and heavy rain indicators from 1981 to 2024 were documented by the Meteorology, Climatology, and Geophysics Agency of Indonesia, confirming the importance of small waterways, alleyways, and riverbanks for normal adaptation.[6] At the kampong level, infrastructure literacy was established as essential for potential design responses. As a hub for education and services, Bandung was further characterized by substantial daily movements of students, workers, and vendors; therefore, there was a demand for flexible, low-cost spaces, and kampong areas were observed to facilitate these movements through informal economies and improvised infrastructure, creating a rich educational environment for linking spatial systems, social norms, and transient patterns (see the map on Figure 1).



Figure 1. Bandung City and ITB's campus with surrounded kampong

What Is a "Kampong"?

In this paper, the term "kampong" is used to describe urban neighborhoods formed through long-term self-development and collective management, rather than through formal real estate development or comprehensive planning. Kampongs typically feature dense housing, narrow access roads, mixed residential and economic uses, and shared management of basic infrastructure. Over time, many kampungs have been absorbed into growing cities and now serve as an integral, if often overlooked, component of urban life.

The term 'kampong' also refers to a self-organized settlement that has arisen in the spaces overlooked by formal planning and land market systems. Historically on the outskirts, many kampongs have been absorbed by urban growth and now serve as essential components of city life, offering accessibility to jobs, support networks, and possibilities for gradual home enhancements.

It has been warned against equating kampong with 'slum' in both typological and ethnographic studies, where robust social structures, adaptable living arrangements, and home-based economic activities are highlighted, even in the face of infrastructure challenges. This differentiation has led to a shift in approach, moving from 'clearing out' to 'enhancing with acknowledgment', highlighting the

knowledge intrinsic to daily practices. At the subdistrict level, urban kampong has been quantified by evaluating factors such as economic capability, infrastructure status, building conditions, and community interactions.[7] Spatial studies indicate that these clusters frequently extend beyond administrative lines and coincide with areas of opportunity, showcasing a natural, interconnected growth pattern.

Previously, the Kampong Improvement Program (KIP) in Jakarta aimed to deliver essential services while recognizing land tenure; more current rights-based initiatives have emerged to protect residency rights and foster collaborative efforts, reminding design teams that both policy and design influence end results. In educational contexts, kampong is viewed as a system of practices that shapes both resilience and vulnerability. Common features, like alleys, small shops, footbridges, and water gates, are regarded as teaching tools that highlight limitations and possibilities, which can be converted into thoughtful, ethical, and context-specific design decisions.[8]

In this study, the Kampong is approached not only as a physical environment but also as a pedagogical environment, where every day spatial practices, such as waste management, circulation, and informal trade, become entry points for studying ethics, responsibility, and contextual design.

Case Vignette: Babakan Siliwangi, Bandung

Babakan Siliwangi transformed rice fields and green spaces into a crowded urban village due to migrations after independence and gradual land development during the 1970s. The building of Ganesha Cultural Center (called Sabuga) in 1995 and Ganesha Sport Center (called Saraga) in 1997 amplified population density, shifting daily activities and opportunities towards the outskirts of the campus.

The area was noted for closely packed homes with little space between them, vertical extensions on inclines, and narrow pathways generally not exceeding 1.5 meters. Streets in the neighborhood, measuring around 1.5–2 meters, gathered small flows of movement and connected with main roads; also observed were mixed ramp-stair pathways. The logistics of how goods traveled, where carts could go, and spots where water accumulated were thus influenced, and limitations for feasible design were defined. Two bridges connecting the kampong to the Institut Teknologi Bandung (ITB) area (on the Sabuga and Saraga sides) served as economic structures intended to create shorter routes for vendors and casual laborers. Because the flow over the bridges fluctuated throughout the day and between weekdays and weekends, it was necessary to consider temporal patterns, not just spatial arrangements, for any suggested alterations. Several spots of the kampong situation as seen on Figure 2.



Figure 2. Babakan Siliwangi element (e.g., bridge/drain /alley/frontage)

An intricate water system was discovered, featuring a colonial-era irrigation channel with operational gates intersecting with neighborhood drainage systems that carried greywater. During heavy rain, both irrigation and drainage were utilized, while flood routes were especially obstructed by debris or structural features. Recording gate functions, instances of blockage in the grids, and maintenance routines by residents was deemed essential for effective design. Community life was centered around mosques, security posts, and the fronts of local shops. Annual celebrations (Independence Day, Eid, elections) and daily interactions (shopping, chatting, repairs) coordinated how space and time were used; thus, proposals needed to honor event schedules, prayer times, and local economies and should include implementation plans that prevent any unintended disruptions.

METHODOLOGY AND ANALYTICAL APPROACH

Both courses utilized a similar structure: preparation (briefings, ethical considerations, and contextual frameworks), team formation (buddy groups), thematic topics (climate, collaboration, community empowerment, and systems/design thinking), iterative mapping and narrative creation, design proposal development, and public sharing (exhibitions). Assessment was integrated at each stage to ensure that the process was clear and appreciated.

The standard progression of COIL was adhered to, building teams, engaging in comparative exchanges, undertaking project tasks, and concluding with presentations that included reflection, ensuring that intercultural discussion was embedded within the course. In this model, Indonesian students served as local informants and co-researchers, while Belgian students took on the role of an ‘outsider perspective’ to foster insightful questions and analogies. As both courses were entirely online, hybrid immersion strategies were applied: local students recorded narrative walks, created short video diaries, developed annotated photo essays, and conducted buddy interviews with community members and intermediaries. Instead of simulating fieldwork, mediated interaction and reflection were designed.

Analysis was conducted by merging narrative coding of student journals with an examination of artifacts (maps, diagrams, posters) and rubric-based evaluations. The rubrics were designed to bring intercultural concepts (awareness → interpretation → collaboration → ethical stance), reflective ideas (iteration, reframing), and contextual ideas (micro-infrastructure knowledge) into action.

Ethical practices were formalized by using consent scripts for images and quotes, and by noting authorship and considerations of benefit directly on posters and in exhibition labels, ensuring that ethical positioning was incorporated into public outputs. A diverse range of results was generated, including co-creation at a local level (for instance, waste sorting stations, tools for gutter upkeep, navigational aids for bridge edges) to international campaigns, such as urban food and water resilience. This variety was seen as proof that suitable ethical and disciplinary ‘entry points’ were found within the limitations of remote collaboration.

Teams reported feeling more at ease with uncertainty and showed enhanced ability to interpret social cues. There was a noted increase in the reworking of project briefs after discussions with partners, and individual observations, like a clogged drain at a corner, revealed that they could initiate multiple design adjustments. Reflective journals suggested a shift from minimization to acceptance and adaptation on the DMIS. Participants shared experiences of adopting slower paces, addressing language differences, and communication styles that honored prayer times, bandwidth constraints, and local festivities.

The exhibitions in Bandung (11–13 June 2025) and Belgium (22–27 June 2025) mandated the need for communication. Curatorial decisions, such as processing timelines alongside prototypes and the incorporation of buddy-chat snippets, were employed as a teaching tool for transparency and accountability. However, disparities in depth among teams were still noticeable. Differences in time zones and schedules caused uneven participation, and in some instances, visual appeal overshadowed the contextual understanding. Consequently, more emphasis was placed on process artifacts during the final assessment.

DISCUSSION: TOWARD A KAMPONG PEDAGOGY

Priority is given to the process instead of striving for perfection. 'Process literacy' describes the capability to explain how limitations transform into understanding and how minor details lead to significant outcomes; qualities such as patience, repeated efforts, and suitable actions are deemed more important than speed and innovation. The kampong serves as an educational resource. Common features like alley dimensions, water controls, scooter pathways, and street-side shops are utilized as learning tools. The documentation of drain upkeep (who does it, when, and with what instruments) is seen as crucial for determining which design decisions are suitable, cost-effective, and sustainable.

Cultural development is understood through DMIS and Deardorff’s competence frameworks. The collaborative nature of outputs and the clear negotiation of timelines, responsibilities, and language are used to facilitate progress along the ethnocentrism to ethno-relativism spectrum toward suitable and effective behavior. The need for alignment among key educational practices such as critical pedagogy (dialogue and shared learning), reflective practice (reassessing in action), and situated learning (engaging in practice) is argued to be essential due to kampong circumstances, where knowledge is shared, implicit, and context dependent.

As a result, the studio is redefined as a space for dialogue and reflective engagement rather than just a location for official results. There is a suggestion that lessons from Bandung can apply elsewhere. In similar dense, self-managed communities, comparable educational chances and ethical responsibilities are likely to arise; the main aspect that can be transferred is the teaching approach, rather than a specific design model.

Risks, Ethics, and Limitations

Dangers of romanticizing and framing issues were reduced by necessitating supportive evidence and opposing examples, which helped to prevent oversimplified narratives. Given that the results were shared publicly, approval for the use of images and quotes was essential; consent details were included on the margins of the posters, and captions were crafted to recognize collaboration, framing ethical considerations as part of the publication process.

Imbalances in online teamwork, such as internet speed issues, differences in equipment, and scheduling conflicts, were tackled through asynchronous methods, tools that require less internet usage, and time-banking systems to ensure fair contributions, along with logs for non-verbal tasks like data cleaning and translation.

Possible bias in evaluation due to emphasis on aesthetics was managed through the design of the rubric, which equally considered process documentation and ethical reasoning with visual communication; additional labels were mandated to explicitly state trade-offs and limitations. The risk of excessive promises during remote collaboration was avoided by prioritizing reasonable actions, having clear exit plans, and providing notes for local follow-up; statements regarding authorship were necessary to clarify the roles of students and the contributions from community participants.

Practical Implications for Future Iterations

Hybrid immersion kits are suggested, containing audio walks recorded on-site, logs for heat and noise, along with brief videos capturing water and waste movements, all organized into concise, labeled sequences for teams to annotate together. Social-code workshops are advised, where prompts for micro-ethnography (like seating arrangements at bridge ends or upkeep of drainage sections) are transformed into concepts for design; any uncertainty should be documented, and different interpretations should be evaluated with teammates.

Infrastructure narratives are recommended, featuring a bridge, a passageway, and a drain as if they were characters, showing their daily “lives” over time to reveal the hidden relationships and timelines that static plans overlook. Assessment based on processes is promoted, where journals, buddy notes, and maps of revisions are recognized as top-tier outputs; examples will be offered to show how thoughtful reflection can change drawings and prototypes. A straightforward language rehearsal is proposed before the exhibition, where input from non-experts is included in the captions and labels.

In terms of focus, MBC aims to promote intercultural creative exploration regarding the climate emergency among undergraduates through COIL, while Atelier Sud at KU Leuven seeks to strengthen international initiatives at the master's level with a specific focus on perspectives from the global south and social responsibility on a worldwide scale.

When it comes to credits and participants, MBC is recognized as a 6 ECTS elective at LUCA School of Arts, attracting around twenty Belgian and twenty Indonesian students who are organized into ten buddy groups; Atelier Sud is acknowledged as a 4 ECTS course at KU Leuven, and the joint initiative was conducted for three credits with three buddy groups to ensure depth of learning.

Regarding the approaches used, methods such as storytelling, mapping, and reflective conversations are common; however, MBC focuses more on the development through COIL, culminating in a public exhibition, while Atelier Sud centers on developing positions that could be expanded into dissertation projects or studio theses.

For outcomes, MBC includes collaborative efforts within local communities to international campaigns, whereas Atelier Sud generally results in strategies or experiments that are sensitive to context and aimed at further academic exploration. In terms of challenges, both programs face limitations of online engagement: restricted sensory interaction and the resulting necessity for

narrative support and patience; additionally, Atelier Sud grapples with the balance between global and local discussions and maintaining coherence across various project strands. The exhibition process in ITB Campus as seen in Figure 3.



Figure 3. Exhibition view

Assessment Rubric, Narrative Guidance

Situated insight is demonstrated when small, often-overlooked features, such as alleys, drains, and bridge ends, are carefully identified and then linked to the systems they shape flows of people and water, daily schedules, and routine maintenance practices. Proficiency is shown when these micro-elements are not treated as isolated details but are explained as working parts of a living network, and when a clear rationale is offered for how they guide design decisions and justify appropriately scaled interventions.

Intercultural empathy is evidenced when engagement moves beyond simple acknowledgment of difference and is expressed through thoughtful interaction and adaptive collaboration. Competence becomes visible when communication styles are adjusted, roles are shared with fairness, and deliverable timelines are negotiated to suit partners' contexts, especially when these adaptations are explicitly documented as moments of collaborative reframing rather than treated as logistical compromises.

Process transparency, ethical positioning, and public communication together form the backbone of responsible practice. Decision-making should be traceable through logs and iterative mapping, with observations clearly connected to the choices they generate, counterevidence addressed directly, and trade-offs explained in plain language. Ethical positioning is strengthened when broad values are translated into concrete commitments, shown in drawings, labels, and authorship statements, while boundaries, exit strategies, and acknowledgements of collaborators are clearly stated on public outputs. Finally, effective public communication is achieved when technical material is translated into simple captions and labels that allow visitors to follow the project's logic and limitations without reliance on studio-specific jargon.

CONCLUSION

By viewing the kampong as a system of practice, significant educational impact has been achieved. It has been demonstrated that everyday features, the width of alleys, water gates, and shop entrances, both constrain and facilitate design, and even small, thoughtful changes have the potential to have significant impact.

Collaborative Online International Learning (COIL) introduces an intercultural dimension. In paired teams, differences are negotiated, shared ownership is developed, and patience is fostered; this ultimately encourages movement along a predetermined growth path toward more adaptive and empathetic practice. When critical pedagogy, reflective practice, and contextual learning are integrated, the studio transitions from simply providing solutions to a space for dialogic and reflective engagement, where knowledge can be co-generated with community and institutional collaborators.

As urban growth and climate threats continue to increase, there is expected to be an increasing need for designers skilled in process and sensitive to context. Kampong pedagogy is suggested as one approach, emphasizing careful observation and translating constraints into ethical action.

While Bandung provides an example, the method is described as applicable elsewhere. It is suggested that these commitments act as teaching methods rather than as rigid design templates, thus enabling education that engages with everyday life in dense and self-sufficient communities elsewhere.

NOTES

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[7]Anindito et al., 'A Quantitative Perspective on Kampung Kota,' International Review for Spatial Planning and Sustainable Development 7, no. 2 (2019): 53–74, https://doi.org/10.14246/irspsd.7.2_53.

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MAKING IT MATTER: TEACHING HISTORY TO STUDENTS WHO ARE NOT HISTORIANS

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INTRODUCTION

The impetus for this essay arose from some of my own frustrations and dilemmas. I teach architectural history, along with other topics like design studios in an accredited architecture program. I would often have students in their fourth year in a studio class, and I would ask them what they recalled from their second-year history class (whether it was mine or others). It was embarrassing and a bit humbling how little they had retained. This is not that surprising, since the traditional way of teaching architectural history is in a lecture format, which is a notoriously poor method for transferring information that can be retained. Since they weren't retaining many details or examples from the course, but were still doing well in the program, I began to wonder if it mattered at all that they were not retaining the material. It is clear that there are strategies more conducive to learning than the traditional slide lecture, but my conclusion, and my argument for today, is that it is not the retention of material and details that matters, but communicating and instilling an enthusiasm for the subject, teaching them "how to enjoy architectural history".[1]

Challenges

In my program, it is clear that students are not retaining details and trivia from their architectural survey, which typically occurs in their first or second year. Though students clearly were not retaining the material from the class, in end-of-semester evaluations, they said they learned a lot, they reported that they enjoyed the class and the content, and I was nominated for teaching awards. Something was going well, but it did not translate into long-term memories of the material.

It is also likely that part of the issue is that courses on architectural history are not perceived as a core component of architectural practice, which is a program to prepare one for professional practice. In other disciplines, there is anecdotal evidence from students interviewed that courses that are not central to their major are ones that they will not invest as much time in, especially if that investment requires significant time in reading and trying to comprehend difficult content.[2] It comes as no surprise in the architecture department that students are motivated to spend more time on the core studio sequence, which is the centerpiece, and the largest credit-hour commitment of the program. The survey of architectural history is a required component of the curriculum sequence, but it is not seen as crucial to the student's professional development. The survey was not meant to be a "gatekeeper" course in the way that organic chemistry is a gatekeeper course for medical students. What I wanted was not to weed out people not cut out for architecture, but to encourage the ones on

the fence. Encouraging students to stay in the program is more important that having them remember small details. If remembering the difference between Brunelleschi and Borromini is not going to happen, we can focus on connecting the process of design and creativity across time frames. The more important issue is generating enthusiasm for the broad and complex narrative arc of architecture, the difficult and messy negotiation that designers face while balancing budget, program, marketing, and professional jealousy. In this, the hope is that the study of history as a study of the activity and challenge of design will be seen as relevant and applicable to their professional training.[3] If that is the case, perhaps the more important issue is not transferring data into students' long-term memory, but engaging them in the excitement of the activity and the joy of the pursuit. Some in the humanities have argued that this is the central task of teaching humanities: to instill "the desire to learn" not to transmit a defined body of data.[4]

Again, if they are not retaining the material, we might ask "what is the reason for teaching architectural history to aspiring architects in the first place?" The schools and the accrediting body for schools of architecture require history and theory courses. When we ask students to define the importance of the architectural history sequence, the will say things like "it will help one to become a better designer because one is familiar with these exemplary precedents." In the past, we had assumed that the idea was to give students a catalog of precedents which would help them to approach their contemporary design projects, and to see the range and diversity of history. However I suggest that it is not a utilitarian effort, where these precedents can be used in professional practice. In any case, the material is not being retained in any sense that would allow it to be recalled in the following semester, much less in the years after they have left the program. If we are not transmitting actionable, useful knowledge and a repertoire of precedents, then what can we be doing? My impression is that for many students, architectural history is the equivalent of a gen ed class: something that is supposed to, in some vague way, make you a better designer or a more well-rounded architect or a more critical and perceptive thinker. There are some subspecialties, such as historic preservation or adaptive reuse where the details of historic architecture are important. There are some utilitarian aspects of this being trained to recall the details of architectural design: architecture is by its nature a generalist profession and its practice requires clarity of presentation and persuasion, and the practice of presenting material and being able to critique projects is (arguably) useful. However, I would suggest that it is not so much the content and the specific data that matters as it is the ability to be critical, to try to understand and argue with the motivations and the ideas behind of the objects of study.

Moving forward

The traditional format for architectural history surveys is through slide presentations. But even here, I suspect that whatever retention does occur is not from the lecture presentation but in the peer-to-peer study groups and flashcard study sessions to prepare for the end-of-semester exam. Even here, the while the research suggests that this "cramming" may be a strategy for retaining material long enough for a final exam, it is not a good strategy for longer term retention. It also points to an essential dilemma or challenge for teaching survey courses: these courses necessarily entail covering a lot of material in a short time.[5] Accredited architecture programs are necessarily constrained by the requirements of the National Architecture Accreditation Board (NAAB), which dictates an extensive checklist of items to be covered. The unintended consequence of this is that schools are under pressure to add ever more material and ever more topics to each course. For faculty who believe that it is important to expose students to the broad range of history, it means that we are trying to cover too much material in too short a time. In contrast, the research would suggest that taking more time and repeating the material is the better way to foster retention.[6]

Next, the question becomes how to determine if the students have engaged with and retained the content of the course. In the age of generative AI, giving take-home tests or tests on platforms like Canvas or Blackboard is pointless. Traditionally, we have thought that it would be a value for students to have a mental repertoire of precedents and examples, but when any example can be found with a search engine, memorizing arcane examples seems pointless to students. Assigning essays as homework is also pointless (though I still do it), Some have advocated a return to in-class blue book written tests.[7] But this is not practical and not even fair, since students have not developed the skills to organize their thoughts into coherent essays, much less the skill to write or even print legibly.

I should note that while this is the case for my subject, but it would not be true for some other classes. For instance, technical courses like codes and building technology are directly relevant both to the assignments that they will use in other classes as well as in their future careers. Biochemistry majors still need to memorize amino acids and their structures; medical students still need to memorize anatomy. Anecdotal conversations suggest that students that are in those technical fields still bristle at the gen ed requirements for humanities topics.[8] Still, proficiency in being able to recall highly specific examples comes from repeated practice in real world applications, not from what is covered in lectures. Survey courses emphasize broad familiarity with a range of examples, but their real value is in encouraging critical thinking and clarity of communication. Those are more ephemeral skills and ones and ones whose value is harder to communicate to students.

My experience suggests a couple of unpleasant realities: students are not retaining the information beyond the class period, or at most the end of the semester; the material that I teach is not directly relevant to what they expect to be doing in their professional activities. Students need to see their history courses as relevant to their design studios and to their eventual practice. It will always be the case that courses that are of broad and general interest, not only architectural history but other humanities courses, will be only indirectly valuable. If the goal is to make this relevant and meaningful to the student, this can be better accomplished by engagement with the student and with fostering a personal connection than by stressing memorization of data.[9]

This suggests that we need interrogate the goal of our courses to make them relevant to students. First we recognize that the purpose of some classes is not to transfer a certain amount of knowledge that is actionable and applicable to daily problems but to foster interest and enjoyment in the broader arc of their major. We recognize that the goal is to engage the students on an emotional as well as intellectual level. Then, we have to be more selective about what is covered, focusing on interesting and engaging material rather than comprehensive surveys. It suggests that, instead of being comprehensive, it may be more valuable to be selective and to take a deep dive into selected stories. This is a challenge to teachers of survey topics where we are under pressure to cover greater amounts of material. Covering too much material in too short a time is counterproductive and actually leads to less retention.[10] Certainly, it also means that we need to emphasize active learning and student projects and student-led presentations over the traditional slide presentation.

Though it may seem superficial, research suggests that the personal connection to the professor and the ephemeral and hard-to-quantify quality of engagement is more important to student development than the collection of facts.[11] This does not address the issue of retention but it does help to explain the earlier mentioned dilemma: that students are reporting satisfaction and enjoyment even if they do not have long-term retention of the material. In addition, it is likely that the sense of engagement is not only valuable for how the students feel about the course, but that it also fosters and encourages greater retention of the material.[12]

I believe that it will be more productive to concentrate on human connections to the design process rather than just the end product. Some of this relies on anecdotes about architects and projects rather

than focusing on details and visual characteristics. For instance, I tell the story of the unfortunate Monsieur Fouquet, who commissioned the French renaissance mansion of Chateaux de Vaux-le-Vicomte and was then thrown in prison by a jealous Louis the XIV, who then went on to have the same architects design Versailles; I share the story of the sensational murder of Stanford White at a party at a venue that White had designed, and I share the happier story of Eero Saarinen winning the Gateway Arch competition. Of course, I would like to have students remember the gardens of Andre Le Notre and the Gilded age designs of McKim, Meade & White, but I hope that having an interesting anecdote to accompany the buildings will make them more memorable.

My inspiration is Vincent Scully, the legendary architectural history professor at Yale who taught the same course for over 50 years. Scully was a dynamic, passionate, and inspiring lecturer teaching a survey of architectural history.[13] Former students praised his course and his personality for transmitting not just information about architectural and urban history, but the skills to be perceptive and to see the world around them. He was so dynamic and engaging that generations of Yale students, not just architecture students, took his classes. Similarly, the influential historian Colin Rowe was noted to have been impactful because of the strength of his personality and for his ability to connect historical studies to the design studio.[14] What this suggests is that we need to recognize and take advantage of the individual interests of each professor. Rather than focus on checklists of topics to covered, it may be more valuable to student development to suggest that an education program is a "well laid table"[15] where each student gets to take advantage of the expert interests of the professor. To paraphrase Maya Angelou, students will not remember what you said, but they will remember how you made them feel.[16] Of course, it is no solution to just say that we need to have dynamic personalities with great stage presence to teach our humanities courses, though I believe it would help.

In addition to shifting the focus away from memorizing buildings and styles, I have looked for studies on evidence-based teaching methods. There are some, but not many that apply to college level humanities courses.

The existing research[17] does have some suggestions for effective pedagogy, like active learning, peer feedback,[18] and project- or team-based learning[19]. It may mean that we focus less on trying to be comprehensive, and more on picking salient and telling examples and have deeper dives into fewer subjects. In my courses, I have implemented this strategy: I still have some days where I try to give an overview of the range of examples and the range of approaches that were taking place at any given time, and I mix that with taking a closer and deeper investigation of a single but important example.

It is clear that we need to adopt strategies like assignments that emphasize team participation, ones that involve student presentations, and classrooms that do not allow the use of digital devices. However, there is a tradeoff for these: they often require extra time. I have tried to address this using the flipped classroom idea of having students read my lecture notes before class, in hopes of encouraging more discussion and participation.

One challenge is to determine what metrics we would us to measure successful teaching in history courses. My current strategy is to survey my students at the end of the course, in an anonymous survey, to assess two things: one, some trivia topics to see what factual material they recall; two, more broad questions about what they remember about topics or periods. My aim is to expand this, to survey students at later intervals in their academic career to get a sense of what impressions as well as details that they retain over time. This, I propose, will be done both one and three semesters later in their academic career. This will help identify what students are retaining and what they enjoyed, but my suspicion is that providing a successful experience for students that helps them to think critically, helps them to view precedents as relevant will not be solved with more or better metrics.

CONCLUSION

I believe that if we want students to separate the historically arcane from the humanely applicable, it will be because students leave the course with a positive impression that the material is interesting and mildly relevant to their future. Since we know that small details like dates and authors will not be retained without regular reinforcement, the goal is to provide a positive memory of the experience of the course. It is also clear that a warm and personal mentor-student relationship contributes to a positive view of the course. Courses like mine that focus on important but not professionally applicable topics, will be valuable when we give up on metrics like memorizing details and focus on the fun, quirky, and relatable stories of history, along with a sense that the professor is caring and supportive.

I suspect that, for the people who trained me, and often to myself, this argument sounds like heresy; it sounds like abandoning rigor and replacing it with entertainment. I hope that is not the case. Instead, I hope that it is an argument for bringing the passion and idiosyncrasies of the instructor into the course, for focusing on the interesting and odd moments rather than the volume of data. The positive feedback I have received from students suggests that this is the case. I hope that this approach will make my courses, which some students see as a necessary but uninteresting requirement, into a productive part of their education process.

NOTES

[1] Mohammad Gharipour. "*Teaching Architectural History to Architecture Students*," interview by Sarah M. Dreller, Society of Architectural Historians, SAH Data Project. Interview with Mohammad Gharilpour., https://sah.org/2020/01/13/teaching-architectural-history-to-architecture-students-an-interview-with-mohammad-gharipour/.
[2] Clay Shirky. *Solution to Cheating*, New York Times, https://www.nytimes.com/2025/08/26/opinion/culture/ai-chatgpt-college-cheating-medieval.html
[3] Mohammad Gharipour. "Teaching Architectural History to Architecture Students," interview by Sarah M. Dreller, Society of Architectural Historians, SAH Data Project. Interview with Mohammad Gharilpour., https://sah.org/2020/01/13/teaching-architectural-history-to-architecture-students-an-interview-with-mohammad-gharipour/
[4] Russell H. Holvbeck History and Humanities, *Teaching as Destructive of Certainty*. (1991) American Historical Association. Retrieved from: https://www.historians.org/perspectives-article/history-and-humanities-teaching-as-destructive-of-certainty/
[5] In fact, in my program, and I suspect in many others, there is always pressure on the program to include more content in each class. In architecture programs, this is partly driven by accreditation requirements, which ask programs to document where they are meeting lengthy checklists of requirements.
[6] Pooja K. Agarwal, Patrice M. Bain. *Powerful Teaching, unleash the science of learning*. Jossey Bass (2019), p. 94
[7] Shirky. New York Times, *Solution to Cheating*,
[8] I have had informal conversations with students in engineering, mathematics, and biology who all reported that, while they were required to take humanities electives, they considered it a distraction from their "real" area of study.
[9] Tahir, K., Ikram, H., et al. (2017) A Model of Effective Teaching in Arts, Humanities, and Social Sciences. Journal of Leadership and Instruction, 16 (1), 27-32. Retrieved from https://touroscholar.touro.edu/gse_pubs/31. They suggest that the key issue is as much the professor's ability to provide psychological support as it is to generate enthusiasm for the course. In other words, enthusiasm for the student-professor relationship may be as important as enthusiasm for the content
[10] Pooja K. Agarwal, Patrice M. Bain. Powerful Teaching, unleash the science of learning. Jossey Bass (2019), p. 94
[11] Tahir, K., et al. 31
[12] Lukowiak, Twila, Hunzicker, Jana. Understanding How and Why college Students Engage in Learning. Journal of Effective Teaching, vol 13, 2013, 44-63.
[13] From remembrances of Vincent Scully, accessed 11/04/2025:
https://news.yale.edu/2017/12/02/remembrances-vincent-scully
[14] Braden R. Engel. Ambichronous Historiography: Colin Rowe and the Teaching of architectural history. Journal of Historiography, Number 14 June 2016. https://doaj.org/article/2a30f833ce844642bec6d17034ab9a1f
[15] Irene Sunwoo. "Between the 'Well-Laid Table' and the 'Marketplace': Alvin Boyarsky's Experiments in Architectural Pedagogy". PhD diss. Princeton University. 2013. ProQuest Dissertations & Theses; 2013.
[16] Maya Angelou said: "I've learned that people will forget what you said, people will forget what you did, but people will never forget how you made them feel." https://www.goodreads.com/quotes/5934-i-ve-learned-that-people-will-forget-what-you-said-people
[17] National Humanities Center; https://nationalhumanitiescenter.org/education-programs/humanities-in-class-guide-thinking-learning-in-humanities/
[18] University of Oxford Centre on Teaching and Learning; https://www.ctl.ox.ac.uk/peer-feedback
[19] Harvard Initiative for Learning; https://hilt.harvard.edu/resource/team-based-learning-humanities

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PEDAGOGIES OF TRANSCORPOREALITY: ARCHITECTURAL THEORY VIA DRAMATURGY

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INTRODUCTION

In recent decades, pedagogies of architectural theory have often endorsed modes of thought rooted in a metrical understanding of space and time. Within this framework, learning to think about architecture has frequently produced distance and estrangement by unfolding through unidirectional teacher–student relationships, dialectical structures grounded in oppositions, and rigid compartmentalizations organized along disciplinary territories.

This paper aims to open and ramify this model by articulating the feminist concept of "transcorporeality" as a pedagogical instrument for practicing architectural theory *in medias res*—in the midst of things. This involves drawing out the poietic dimension of thought in pursuit of articulating its situated condition in a participatory key: learning and practicing architectural theory as the cultivation of multiple literacies no longer exercised against other individuals, but crafted, written, read, and spoken among and with other corporealities—whatever organic or inorganic forms they may take.

Methodologically, the article develops these considerations through the case study of a semester seminar in architectural theory offered at the Technische Universität Wien. The course favors flipped classrooms and peer-to-peer learning by encouraging students to develop a dramaturgical plot whose narrative revolves around a research question in architectural theory. The collaborative design of a scenario, narrative, and set of characters unfolds in dialogue with a curated bibliography, bringing together diverse academic voices on the architectural topic addressed by each group. The elaboration of such dialogical fictions mobilizes modes of imagination and hypothetical reasoning that grow and mature through the interplay of story-telling, academic works and horizontal interaction.

BETWEEN DIALECTICS AND FIRST-PERSONALISM IN ARCHITECTURAL THEORY

In what was perhaps its last glorious momentum in Western academia, architectural theory was described by Michael K. Hays as an "appetite for modifying and expanding reality, the desire to organize a new vision of a world perceived as unsatisfactory or incomplete".[1] Architecture is here apprehended as the constant remaking of the world: far from dissolving into its historical context, architecture "necessarily remains in *dialectical* tension with its own historical moment; it is not capable of sublating art and life, but neither can the discursive and institutional authorities completely control and exhaust architecture".[2] Hays conceives the architectural practice as entangled within a

complex of social, technological, and historical forces that are deep-seated, perhaps repressed, and yet "shifting and contradictory". What is then the role of architecture? Hays responds: "to retain the power to *negate* certain dimensions of historical social life and expose undiscovered spaces, expanding the territory on which we dwell".[3] The term "negation" is important here; however much social and historical conditions determine the production of architecture, architecture is meant to push back against its context, contesting those forces that aim to determine the very conditions of its own production.

The practice of architectural theory here is ultimately based on a fixed, metrical conception of space and time. I am referring less to the space and time in which architecture, as a practice, unfolds, than to the space and time within thought unfolds. For not only thought here is ultimately divided and distributed across epistemic territories according to disciplinary rules, but it proceeds *dialectically*: it unfolds through the confrontation of thesis and antithesis as incommensurable positions alternating each other on a flat coordinated canvas. Hays instrumentalizes Adorno's negative dialectics by preserving the tension between opposing ideas under the conviction that synthesis and reconciliation ultimately turns real antagonism into a conceptual harmony that undermines all subversive power. To think about architecture is then to navigate through the heterogeneity of conceptual constellations that do not resolve or reduce into a single structure.

Within this framework, learning to think about architecture has frequently produced distance and estrangement through a set-up in which thesis and antithesis are meant to incessantly debate one another while spectators await an ever new next turn. In being grounded in oppositions and rigid compartmentalizations organized along disciplinary territories, dialectical structures favor unidirectional teacher-student relationships, as they unfold through master concepts, canonical progressions and disembodiment.[4]

However, in various design realms dialectics are today being questioned. Anna Kornbluh, cultural critic and intellectual activist, has recently published a book in which she frames the erosion of dialectical milieus in today's design culture with the term *immediacy*. With this vocable Kornbluh describes nothing less than an *inversion* of postmodernity,[5] but one that does not conjure the positivist ghosts of earlier epochs. She instead takes seriously that notions such as "presence", "instantaneity", "directness", "flow" or "immersion" have become the "master categories" of today's design culture, what Frederic Jameson would call the "cultural dominants".[6] In this context, dialectics as a theoretical methodology has been submerged by immediacy as an endgame. Theory here becomes concrete and fluid, emerging as a response to the impersonal abstraction, masculinist reserve, and rationalist systematicity it seeks to correct. Immediacy favors the fluidization of fixed norms and entrenched positions, continuously re-elaborating the very metricity on which they are based; it invites us to move beyond explanatory dialectics and its tendency to frame thought within an external, metric framework which reduces thinking to a conflict between fixed positions.

The risk, of course, lies in mistaking this invitation for a call to practice theory as a "auto-authorizing, lyrical, fragmented first-personalism".[7] To privilege one's intimate experience as a locus of thought often precludes distance-taking and concept-making in favor of the personal, the private, the autobiographical. It substitutes universality with anecdote, argumentation with charisma, abstraction with affect, interpretation with confession, conceptual elaboration with sensory attunement.[8]

What I want to propose in this paper is to engage with immediacy not that much as a cultural trend to be dismissed or fortified against dialectics—which would simply prolong it, but as the "seed" of an epistemic condition to be cultivated. I suggest conceiving today's disintermediation in culture less as an "object of analysis" than as "a *vehicle* of thought" to grow modes of imagination and hypothetical reasoning that unfold "*in medias res*"—in the midst of things. This might seem contradictory at first

sight: Isn't theory, first and foremost, "a practice of mediation"?.[9] Mediation as intercession; thick, slow, deep. Theory; the *medium* par excellence, that domain in which we can take distance from the immediate, from the merely evident, and perceive the systematic and surprising interrelation of culture. What, then, could it mean to practice architectural theory in the midst of things? How can the category of "immediacy" offer a site of mediation? Is it even possible? And why try? What is the promise of conceiving today's disintermediation in design culture as a site for architectural thinking? What does it offer, what can it do?

To conceive today's immediacy as a site for architectural thinking is not to abandon conceptual mediation in theoretical work. It is an invitation to practice theory in an immersive key. The image is that of an acrobat carefully walking a suspended rope: on one side, the fixed metricity of dialectics; on the other, the complacency of first-personalism. What I propose is to articulate the situated condition of thought in a participatory key: thinking as a practice no longer carried in opposition or through self-experience, but crafted, written, read, and spoken *among* and *with* other *corporealities*, whatever organic or inorganic forms they may take. I propose to call such thinking *transcorporeal*.

TRANSCORPOREAL THINKING

So what is transcorporeal thinking? The conceptual roots of transcorporeality go back to phenomenology, especially to Maurice Merleau-Ponty. With the term *intercorporéité*, Merleau-Ponty designates the reversible relation between one's own body and the other's body: I touch and am touched; I see and am seen.[10] Both bodies are like the obverse and the reverse of one and the same flesh.[11] The "trans" in transcorporeal thinking signals that just as there is a reversibility between seeing and being seen, so too is there a reversibility between the sound of a speech and its signification.[12] Thought is not on the body like butter on the bread—like a layer of "ideal reality" spread over nature, but it is rather an *embodied* act.

In questioning the master subject of Western humanism, Merleau-Ponty gained significance in Feminist thinking, particularly, in the work of Stacy Alaimo, where the term *transcorporeality* appears for the first time.[13] By introducing gendered, social, political, and ecological dimensions into Merleau-Ponty's otherwise neutral flesh, the "trans" in transcorporeal thinking signals that the material crossings of bodily interaction can always be interpreted in *axiological* terms: any corporeality is a trans-corporeality insofar as its transits across the sensible both shape and respond to a world of values and significations.

Yet a thinking that is in transit is a thinking that exceeds the bounds of one's individual, private experience. Its subject of enunciation may have an origin, a homeland, a name, yet nominality does not exhaust thought: the "trans" in transcorporeal thinking signals here modes of thinking that engage with the *universal* insofar as, by exceeding the ambit of private experience, it participates in the public space of reason and its logico-mathematical dimensions. It is a thinking that is never entirely one's own, that comes from elsewhere and that begins to make sense and take hold only when one can propel its transit further.

Embodiment, axiology, universality. Or in other words: Sensorial perception, world-making insight, and conceptual structure. In contrast with dialectics, transcorporeal thinking is bodily situated and socio-politically engaged, and yet, differently from first-personalism, the ideas it articulates are sensible to conceptual normativity. The promise of conceiving today's disintermediation in design culture as a vehicle of thought lies in developing more manners to perform embodied acts of abstraction: thinking as a conceptual practice that unfolds "among" things, rather than "adrift" in the open night sky.[14] What is important for thinking of pedagogies of architectural theory in terms of transcorporeality is then the combination of sensorial perception, world-making insight, and

conceptual structure in the modes of reasoning and imagination that we may cultivate in dialogue with today's disintermediation of design culture.

So how does this relate to theory as a research and pedagogical practice?

In its commitment to an objectivity of variable metricity, transcorporeal thinking neither aims "to explain phenomena" nor "to archive facts", but "to cultivate *literacies*"—that is, to become competent in codes or notational systems that develop through interaction with experience. To think amid things is not to disregard systematicity—axioms and elements, unity and generalization—but to learn to instrumentalize it by mingling with the world, much as we do, for example, when learning to swim.[15] As in the learning of any bodily skill, *thinking in medias res* involves the gradual acquisition of literacies through active immersion in the environment. Yet, however apt these literacies may be, none of them exhausts its object of thought—just as, however proficiently one may swim in a given style, one never exhausts all that swimming can be.

Such an interest in immersion as a site to practice conceptual mediation diverges from the contemplative connotations embedded in the etymology of the term "theory". To invent and develop "literacies of transcorporeality" is to abandon the idea that theory consists in the solitary crafting of doctrines whose teaching would carry them untouched from one mind to another, like a relay baton passed from runner to runner.

Teaching, then, rarely takes place through a table placed before an audience. To think among and with other corporealities is not to adopt the panopticon view, as if hovering like a bird above what calls our thought.[16] It rather invites us to adopt pedagogies such as engaged learning, flipped classrooms or peer-to-peer activities, but also to approach the theoretical and historical canon as gymnastic exercises; exercises to acquire skills as much as to inquire what the "corpus of knowledge" is capable of when approached as a public construction site.

Yet this is not to serve design in any direct manner, as if design would merely illustrate what theory manifests, or theory would simply make explicit what design does. Here, theory is, above all, exercise: conceptual training, the acquisition of literacies that, by expanding our ability to perform embodied acts of abstraction, *shape our disposition* to address all that involves design: from policy planning and market advertising to creative conceptualization, construction protocols, and decision assessment. To think *in medias res* is thus not to claim expertise of this or that particular problem, but to address all what can be considered, yet without ever claiming to say it all, without saturating things, with a willingness to elaborate transversal models rather than to unveil exhaustive images.

CASE STUDY: ARCHITECTURAL THEORY VIA DRAMATURGY

I propose to develop these considerations through the case study of a semester seminar in architectural theory offered at the Technische Universität Wien. The course favors flipped classrooms and peer-to-peer learning by encouraging each student group to develop a theater plot whose narrative revolves around a research question in architectural theory. The three key elements of transcorporeality previously described—sensorial perception, world-making insight, and conceptual structure—are addressed by combining, on the one side, the critical thinking, academic precision, research orientation, and objective distance typical of architectural theory, and, on the other, the storytelling, narrative expression, situatedness, and subjective involvement characteristic of dramaturgic plot development.

The collaborative design of a scenario, narrative, and set of characters unfolds in dialogue with a curated bibliography that brings together diverse academic voices on the architectural topic addressed by each group of students. The teams ultimately develop what could be described as a dramaturgical treatise: a fifteen-minute theatrical plot whose dialogues revolve around a research question and

incorporate quotations from various thinkers related to the topic at hand. This format favors a multiperspectival, speculative, and situated approach, as the elaboration of such dialogical fictions mobilizes modes of imagination and hypothetical reasoning that grow and mature through the interplay of storytelling and academic work. The aim is to articulate sites from which to talk in terms of resonance and reverberation, in terms eluding both the sanitized interplay of thesis and antithesis characteristic of dialectics, and the confidential and thus strictly private tone of lyrical first-personalism. Working in groups, students invent situated, narrative and conversational arrangements where questions are dramatized rather than replied, where theses and arguments unfold as if a great dining table was set up, a feast that invites discussion, negotiation and trial, but also decision and resolution, confirmation. Dining tables might do that by accommodating all sorts of humors: laughter, claims, hopes, tears, prayers, declarations, songs, advice…

Upon successful completion of the course, students are meant to approach the complexity of an architectural task in a polyvocal, critical, and inventive manner. They have developed experience in reading across disciplines, engaging abstractly with texts, and participating in collaborative discussions. This includes cultivating a range of techniques for understanding, articulating, and situating themes of interest within shifting contexts and in response to multiple purposes. Moreover, students are able to communicate both dialogically and narratively, integrating textual, visual, and sonic forms of expression.

Methodologically, the seminar consists of 11 three-hour sessions held over four months, with 30 master's students divided into six groups of five. After an introductory session outlining the course structure and group formation, each team receives a kick-off research question along with an initial five-item academic bibliography, offering different approaches and levels of engagement with the assigned topic. From here on, the course unfolds in three main phases of three sessions each.

The first phase, called *impression*, encourages students to assemble a constellation of keywords, images, and references that address their research question from multiple angles and in diverse ways. During the first two sessions, this work includes the development of a glossary, a catalogue of audiovisual materials, and a reservoir of quotations. In the final session of this phase, students are invited to propose three possible dramaturgic set-ups—real locations in the world—where their theatrical plot could take place and that bear a meaningful relation to their research question.

In the second phase, *compression*, students are prompted to articulate the knowledge gained during the first phase into a dramaturgical narrative. The first session is devoted to the design of five or six characters: drawing on a set of literary and cinematic models, students bring their characters to life through a collage of images and sounds, accompanied by a brief text that meaningfully connects each character to the theme of the research question. The second and third sessions focus on developing the narrative of the plot—in three to five acts—and writing dialogues between the characters, incorporating quotations from the academic references gathered in phase one.

In the final phase, *expression*, students concentrate on the communication of their work while they keep developing their narrative and engagement with the research question. The first session introduces Readymag—a web-based design platform—as a tool for showcasing their dramaturgical projects. They are also provided with a layout that liberates them from the task of designing the distribution of the information in the screen, providing them with a structure that includes the position, size and typography of the title, subtitle, list of characters, dialogues, parentheticals, quotations, images, footnotes, references and bibliography.

Finally, the last session is devoted to the presentation of the work. Each student group sits in a semicircle facing the class, with their Readymag page projected behind them. The performance consists of reading the plot aloud: some students take on the roles of individual characters, another

reads the voice of the narrator (the parentheticals), and another scrolls through the Readymag page as the dialogue unfolds. There is not a real acting in this presentation—as it would be in a theater plot, but students are encouraged to modulate the intonation, volume and general expressivity of their voice according to the character that they are embodying.

CONCLUSION

Teaching here becomes a collaborative activity which has nothing to do with becoming an expert in one's particular field. Instead, one could liken it to the master-apprentice relation of the medieval guilds, where the purpose of the teaching craft is to "let learning occur".[17] One could also bring the etymology of the term education; from the Latin *educere*, composed of the particles *ex*, towards the exterior, and *ducere,* to guide, to conduct, that is, the practice of guiding what one already has in a latent state towards an outside. Along these lines, further pedagogical methodologies grounded in transcorporeality could be developed.

NOTES

[1] Michael K. Hays, “Introduction”, in *Architectural Theory since 1968*, ed. Michel Hays (Cambridge: The MIT Press, 1998), xiv.
[2] Michael K. Hays, “Architecture’s Appearance and the Practices of Imagination.” *Log* No. 37 (Spring/Summer 2016), pp. 205.
[3] Hays, *Architecture’s Appearance*, 206.
[4] Master concepts: since dialectics require reading certain conceptual structures against their own claims, the teacher appears as the one who already knows how concepts fail, while students are still caught in naïve identification. Canonical progressions: since dialectics unfolds through the game of thesis and antithesis, knowledge is often presented in a linear cumulative sequence that requires the mastery of antecedents. Disembodiment: since dialectics favors the conceptual negation of that which is affirmed, situatedness and corporeality are treated as insufficient or secondary insofar as they are not abstract instruments of critique.
[5] “Where postmodernism revels in mediation—intertextuality, irony, the meta—immediacy negates mediation to effect flow and indistinction. Where postmodernism aesthetically activates pastiche, a “blank,” playful “heterogeneity without a norm,” immediacy precipitates blur, a de-mediated meld that lacks the contours to array heterogeneity. Where postmodernism aesthetically and epistemically embraces the surface and eschews depth, immediacy mires itself in profundities of corporeality, affect, and polarized extremity. Where postmodern affect undergoes “waning”—a dilution of modernist ferocity like anomie and alienation into “free-floating” flatness—immediacy’s affects wax rapt and veritable. Where postmodernism inscribes “a crisis of historicity,” immediacy encodes a crisis of futurity, a beclouded nonhorizon.”
Anna Kornbluh, *Immediacy, or the style of too late capitalism* (London: Verso Books, 2024), 13.
[6] Kornbluh, *Immediacy*, 5.
[7] Anna Kornbluh, *Immediacy, or the style of too late capitalism* (London: Verso Books, 2024), 150.
[8] The following texts are adequate references of lyrical self-personalism:
Paul B. Preciado. *Dysphoria mundi* (Madrid: Anagrama, 2022).
McKenzie Wark. *Raving* (Duke: Duke University Press Books, 2023).
Timothy Morton. *Hell*. (Columbia: Columbia University Press, 2024).
[9] Michel Hays, “Introduction”, in *Architectural Theory since 1968*, i.
[10] “The presumptive domain of the visible and the tangible, which extends further than the things I touch and see at present”
Maurice Merleau-Ponty, *The Visible and the Invisible*, Trans. Alphonso Lingis (Evanston: Northwestern University Press, 1968), 122.
[11] Merleau-Ponty, *The Visible and the Invisible*, 123.
[12] “The signification is what comes to seal, to close, to gather up the multiplicity of the physical, physiological, linguistic means of elocution, to contract them into one sole act, as the vision comes to complete the aesthesiological body”
Merleau-Ponty, *The Visible and the Invisible*, 154.
[13] The notion of trans-corporeality has been developed in depth by scholar Stacy Alaimo.
Stacy Alaimo, *Bodily Natures: Science, Environment, and the Material Self* (Indiana: Indiana University Press: 2010), 2.
[14] This is to engage with what Donna Haraway calls the challenge of today’s theoretical thinking:
“So, I think my problem, and “our” problem, is how to have simultaneously an account of radical historical contingency for all knowledge claims and knowing subjects, a critical practice for recognizing our own “semiotic technologies” for making meanings, and a no-nonsense commitment to faithful accounts of a “real” world, one that can be partially shared and that is friendly to earthwide projects of finite freedom, adequate material abundance, modest meaning in suffering, and limited happiness.” Knowing subjects and historical contingency, real worlds and truthful accounts. To think *in medias res* is not to abandon mediation—which, as we have seen with Hays would simply suspend the possibility of theoretical work, but to mediate in an immersive key. And this invites us to acknowledge that subjectivity and objectivity constitute each other while retaining their own purposes: many subjects inform and engage with an idea of objectivity, many objects calibrate an idea of subjectivity#. Such a chiasmic interplay between objectivity and subjectivity prompts us to abandon the anthropological premium by committing again to the cosmos; addressing objectivity not as a fixed framework but as a plurality of reengineerable metricities invites us to remain loquacious toward everything and everyone; it opens up the possibility of elaborating multiple codes or notational systems through which rigorously contract a

coexistence of things—at the cost, of course, of never claiming exhaustive knowledge of anything. But this is not the place to expand on the philosophical implications of interweaving subjectivity and objectivity.
Donna Haraway, “Situated Knowledges: The Science Question in Feminism and the Privilege of Partial Perspective” *Feminist Studies 14*, no. 3 (1988): 575–599.

[15] “If we had never seen a man swim,” writes Henri Bergson in *Creative evolution*, “we might say that swimming is an impossible thing, inasmuch as, to learn to swim, we must begin by holding ourselves up in the water and, consequently, already know how to swim. [...] But if, quite simply, I throw myself up well enough at first by merely struggling, and gradually adapt myself to the new environment: I shall thus have learnt to swim.”
Henri Bergson, *Creative Evolution,* trans. Arthur Mitchell (New York: Dover Publications INC, 1998), 192.

[16] To think among and with other corporealities is not to view them as intelligent in virtue of their computing power but to approach them in their intelligibility.

[17] Heidegger, *What is called thinking*, trans. J. Glenn Gray (London: Harper and Row Publishers, 1968) 2.

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FROM DATA TO DIALOGUE: KNOWLEDGE INTEGRATION IN SÃO PAULO'S REAL-WORLD LABORATORIES[1]

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INTRODUCTION

This chapter examines two case studies in São Paulo: the LAB Itaim Paulista and the LAB Ermelino Matarazzo. Together, they illustrate how participatory actions, communication strategies, and visual mediation tools can support knowledge integration and shared understanding among highly heterogeneous actors. The analysis underscores the role of interaction and communication as preconditions for effective participation and democratic urban governance, contributing to ongoing debates on co-production, climate adaptation, and planning practices in peripheral urban contexts.

CO-PRODUCTION AND KNOWLEDGE INTEGRATION IN PERIPHERAL URBAN AREAS

In the context of accelerating climate change and deepening socio-environmental inequalities, co-production has emerged as a strategic paradigm for urban planning and governance. Particularly in vulnerable territories, decisions related to land use, infrastructure, and risk management are often complex, contested, and politically sensitive. Co-production responds to these challenges by promoting collaboration among public authorities, academic institutions, and community actors, recognizing the plurality of knowledge systems that produce the city.

Rather than privileging technical expertise alone, co-production seeks to integrate scientific knowledge, policy perspectives, and everyday experiences. This integrative approach enables more nuanced understandings of urban problems that do not lend themselves to unilateral solutions. By articulating diverse rationalities, co-production expands the potential for consensus-building, mutual learning, and collective action, thereby strengthening the legitimacy and effectiveness of urban interventions.

Scholars have highlighted the relevance of inclusive approaches in which researchers act not as leaders but as participants in broader social processes, creating space for civil society contributions and local agency. In the Global South, where informal settlements constitute a significant share of urbanization, co-production has been discussed as both an opportunity and a challenge. Governance arrangements based solely on state-centric perspectives risk reinforcing structural inequalities, while participatory processes that fail to connect with institutional planning may remain symbolic or short-lived.

Ruíz-Mallén points out that an inclusive approach, which provides space for civil society contributions and sees researchers more as participants in the process than as leaders, is key to adapting urban planning frameworks to modern challenges, such as climate resilience and social inclusion.[2] Gałuszka addresses co-production and co-governance in the Global South, where irregular

settlements serve as a case study of urban organization and development. He also critically discusses the role of co-production, highlighting the conflict between planning systems and the most vulnerable urban areas, in which governance schemes guided solely by the vision of public power can open the door to the institutionalization of inequalities. By identifying the different levels and interlinkages of co-production, the paper argues for a deeper, more complex understanding of its implications for policy and governance structures.[3] Following Gałuszka's line, Siame and Watson analyze how co-production can reshape governance in the Global South, highlighting its potential to alter consolidated systems of urban governance and to empower marginalized groups. To do so, they base their analysis on a case of co-governance considered exemplary in Uganda. The study emphasizes the importance of evaluating whether the co-production process enabled the expansion of a local project into a macro context and whether it brought lasting changes to governmental urban processes, avoiding being limited to one-off action.[4]

Despite recognition of the importance of co-production in urban planning, challenges persist due to imbalances in repertoire, vision, and experience among actors, as well as the limitations imposed by actors' practices, rules, and cultures. As Wamsler notes, structured collaboration between authorities and citizens is practically nonexistent, often constrained by inadequate financial and structural support instruments and institutional arrangements that do not align with the population's capacities, needs, and daily knowledge. These asymmetries demand strategic interventions that strengthen interaction between the city and its citizens and constitute a central element in promoting transformative adaptation capable of articulating different scales of action and redefining the relations between public power and society in the context of urban planning.[5]

Adding to this scenario are the challenges of integrating co-production into urban governance, exacerbated by the difficulty of reconciling diverse interests among public management, academia, and residents. Black et al. note that planning processes remain strongly conditioned by economic and institutional logics, which limit the incorporation of other knowledge and values into decision-making.[6]

Despite its recognized potential, co-production faces persistent obstacles. Asymmetries in language, expertise, and institutional power often hinder effective collaboration. Planning cultures, administrative routines, and funding structures may not align with local communities' capacities and needs. As a result, structured collaboration between authorities and citizens remains rare, particularly in climate adaptation. Addressing these asymmetries requires deliberate interventions to strengthen communication, mediation, and shared learning across scales and sectors.

In large metropolitan regions of the Global South, informal and precarious urbanization poses persistent governance challenges, particularly in areas exposed to climate-related risks such as flooding, heat waves, and pollution. Traditional top-down planning approaches, often grounded exclusively in technical rationalities, have proven insufficient to address these complex conditions. By contrast, purely bottom-up initiatives may struggle to influence broader planning frameworks and institutional decision-making. Against this backdrop, the Klimapolis Real-World Laboratories were designed to serve as mediating arenas, translating technical data into accessible knowledge and incorporating local experiences and cultural practices into planning processes. [7]

FROM DATA TO DIALOGUE IN THE KLIMAPOLIS REAL-WORLD LABORATORIES

The Klimapolis project was launched in 2018 with funding from the German Federal Ministry of Education and Research and was jointly hosted by the Max Planck Institute for Meteorology in Hamburg and the Institute of Astronomy, Geophysics, and Atmospheric Sciences at the University of São Paulo. Its overarching goal was to contribute to more resilient and sustainable cities by strengthening democratic, science-based public policies through international scientific cooperation.

In 2022, the Brazilian team institutionalized the initiative by creating the INCT Klimapolis, ensuring continuity beyond the original project's conclusion in 2024.

As an experimental approach to climate urban governance, Klimapolis adopted the Real-World Laboratory methodology, which has been promoted in European contexts to accelerate urban transitions toward sustainability. RWLs are characterized as transdisciplinary spaces that integrate civil society, universities, and public authorities in the co-production of urban solutions. By combining scientific research with practical experimentation in real-world contexts, they aim to generate actionable knowledge to address complex urban problems.[8]

Castellanos and Lemos, in a contribution to the 12th chapter of the 6th IPCC Report, report on the state of adaptation of Central and South American cities to extreme events. They describe how scarce resources are used in a fragmented way, thereby harming the efficiency that could be achieved through sectoral integration of public policies.[9] Alvim, Marques, and Jacobi also identify the same problem and note that Brazil and the State of São Paulo have established relevant institutional frameworks, including national, state, and municipal climate policies, but implementation remains limited, centralized, and poorly articulated across scales.[10]

In São Paulo, RWLs were mobilized as a strategy to address gaps in intersectoral governance and fragmented policy implementation, particularly in peripheral territories. The laboratories were designed to facilitate communication among municipal departments, technical experts, researchers, and residents, fostering a shared understanding of local problems and negotiated responses. The first pilot was implemented in the Subprefecture of Itaim Paulista, giving rise to the LAB Itaim Paulista. LAB Itaim Paulista promoted a set of transdisciplinary activities, experiments in a real context, and a search for continuous reflective learning, with the objective of delimiting new research objects integrated with the local reality, influencing institutional practices and public policies, and training managers and the local community for the proposed dialogue.[11]

THE LAB ITAIM PAULISTA: PARTICIPATORY ACTION AS A COMMUNICATION STRATEGY

The Subprefecture of Itaim Paulista is located in São Paulo's eastern periphery, an area characterized by lower development indicators and heightened socio-spatial vulnerability. The territory is intersected by several streams and comprises predominantly social housing estates, informal subdivisions, and favelas. As a result, it concentrates challenges related to urban drainage, sanitation, and solid waste management, particularly in areas adjacent to watercourses.

The LAB Itaim Paulista was conceived as a Real-World Laboratory aimed at articulating research, learning, and transformation within this local context. Its activities were supported by formal cooperation among the university, municipal government, and local actors. The laboratory sought to integrate technical, scientific, and administrative knowledge with residents' everyday experiences, focusing especially on socio-environmental vulnerabilities and extreme rainfall events.

A central feature of the LAB Itaim Paulista was the use of participatory actions as strategies for communication and knowledge translation. Three initiatives were particularly relevant: "The Book of Dreams," a workshop on air pollution sensors, and the co-design of a community center. These activities were designed to enable residents to appropriate question and reinterpret technical data and diagnoses considering their lived experiences, thereby functioning as mediating devices between science, policy, and community.

"The Book of Dreams," implemented in August 2019 at Praça da Mãe Preta, exemplified the potential of creative and pedagogical tools for collective expression. The initiative brought together teachers, students, residents, and local authorities to foster dialogue and put into practice a pedagogical strategy

which employs Art Education as a resource to address environmental problems.[12] Organized in partnership with a local public school and the Subprefecture, the activity addressed the problem of irregular waste disposal in a public square and an adjacent stream. Through a guided walk and drawing exercises, participants recorded their perceptions of the environment. The resulting drawings were compiled into a collective book that served as the basis for dialogue with local authorities. The process shown in Figure 1 transformed everyday experiences into legitimate inputs for urban planning while reducing communication asymmetries between residents and public officials.



Figure 1. Process of the "Book of Dreams", (2019). Source: authors.

A second initiative involved a workshop on atmospheric sensors conducted with students from the same school. By engaging directly with scientific instruments and data on air pollution, participants were introduced to technical concepts through a mediated, situated learning process. The activity addressed local practices such as waste burning and linked them to broader health and environmental impacts as can be seen in Figure 2. This form of engagement represented a deeper level of co-production, in which scientific knowledge was not only communicated but actively reinterpreted through local experience.

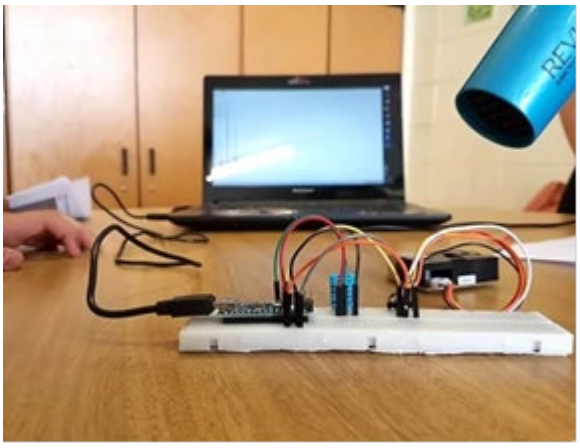


Figure 2. Community-Based Air Quality Sensor Workshop, (2019). Source: authors

The third initiative—the co-design of a community center in the Favela do Torresmo—illustrated a more advanced stage of co-production. Developed collaboratively by the LAB Itaim Paulista, university extension groups, and research institutions, the project translated a long-standing community demand into a technically and institutionally viable proposal. By directly influencing

programmatic and design decisions, the process strengthened collaborative governance mechanisms and demonstrated RWLs' potential to align social, technical, and administrative interests.

The particularities observed throughout the described experiences lie in the origin of concrete urban conflicts and in the need for constant methodological adaptation to conditions of socio-spatial inequality, institutional instability, and high urban pressure, which gives the laboratory a procedural, incremental, and deeply rooted character in the territory. In this way, LAB Itaim Paulista broadens the conceptual scope of RWLs by demonstrating how this methodology can be operationalized in peripheral contexts of the Global South, in which co-production is not only a methodological choice, but a necessary condition for the legitimacy, viability, and effectiveness of urban transformations.

THE LAB ERMELINO MATARAZZO: TRANSLATING DRAINAGE PLANNING KNOWLEDGE

Urban drainage planning in São Paulo involves challenges that extend beyond technical dimensions, encompassing governance issues, land-use conflicts, and historical patterns of urbanization. Divergent expectations among residents, technicians, and public managers, along with distinct sectoral planning cultures, often complicate the acceptance and implementation of infrastructure projects. In vulnerable territories, building consensus requires deliberate efforts to create spaces for dialogue and shared understanding.

The LAB Ermelino Matarazzo emerged from a technical cooperation among INCT Klimapolis, Mackenzie Presbyterian University, the Municipal Secretariat for Climate Change, and the Municipal Secretariat for Urban Infrastructure. Its objective was to integrate community actors and local government into the preparation of the drainage plan for the Mongaguá and Dois Irmãos watershed. Drawing on lessons from the LAB Itaim Paulista, the laboratory adopted experimental engagement and communication strategies inspired by the RWL approach.

Located in a densely populated area with high soil impermeability and recurrent flooding, the watershed encompasses more than 200,000 residents. Through continuous dialogue with residents, civil defense, and the local subprefecture, the LAB Ermelino facilitated the co-production of communication tools, culminating in the preparation of a popular summary of the drainage plan. This material directly responded to community demands for clearer explanations of technical proposals presented at public hearings.

Between April and September 2025, the laboratory conducted a series of participatory actions, including field visits, technical inspections, institutional meetings, and public events. Field visits played a central role, serving as analytical tools, coordination devices, and informal learning spaces. Conducted by multidisciplinary teams, these visits enabled a shared diagnosis of drainage conditions, identification of critical points, and alignment of perspectives across institutions and community actors.

PARTICIPATORY ACTIONS OF THE LAB ERMELINO

Field visits played a central role in consolidating routines of communication and cooperation among institutional actors, enabling the progressive alignment of understandings of local problems and the formulation of guidelines for urban drainage planning. These technical visits functioned simultaneously as instruments of spatial analysis, mechanisms of interinstitutional coordination, and informal spaces for collective learning.

Between April and September 2025, the LAB Ermelino conducted 18 participatory actions, structured into four main types: (i) shared recognition and diagnosis, (ii) fieldwork and technical site visits, (iii) technical and institutional meetings, and (iv) social interactions and public events. Together, these activities supported an incremental and relational approach to urban drainage planning.

Seven of these actions involved on-site engagement, including four technical visits carried out through diagnostic walks across the watershed. Their primary objectives were to understand the functioning of stormwater drainage galleries, identify critical points and infrastructure conflicts, and document channel morphology, connections to micro drainage systems, and local maintenance and urbanization conditions. Conducted by a multidisciplinary team—including members of LAB Ermelino, municipal infrastructure agencies, the University of São Paulo's Hydraulic Technology Center, the local subprefecture, and Civil Defense—these visits enabled shared, multiscale diagnoses of drainage challenges.

Complementing the technical approach, participatory actions followed the experimental logic of Real-World Laboratories by strengthening links between government and residents and expanding social capacity to respond to complex urban problems. By integrating technical knowledge, institutional experience, and residents' everyday perspectives, these interactions laid the foundations for a multisectoral, democratic drainage plan, reinforcing both its legitimacy and the role of Real-World Laboratories as instruments of urban governance in highly vulnerable contexts.

VISUAL MEDIATION AND ACCESSIBILITY OF TECHNICAL INFORMATION

The importance of visual mediation became particularly evident during the first public hearing on the drainage plan, held in July 2025. To support participation, the LAB Ermelino introduced a watershed map and a physical model of the area as recorded in Figure 3, translating complex technical content into accessible visual representations. These artifacts facilitated understanding of spatial boundaries, topography, and hydrological dynamics, enabling more equitable participation in the debate.



Figure 3. Physical Model of Ermelino, (2025). Source: authors

Despite these efforts, residents reported ongoing difficulty with technical language and requested simpler, more visual materials. In response, the LAB Ermelino collaborated with technical teams to redesign presentation materials, using clear illustrations and short animations that explained how the proposed interventions worked. These visual tools were incorporated into subsequent public hearings and significantly improved comprehension and engagement.

The positive reception of these materials led to the development of a popular summary titled "The River Is My Neighbor?", Figure 4. The summary was produced from the illustrations used during the hearing, with the aim of consolidating and expanding access to the information discussed collectively. The material presents, in a clear and concise manner, the definition of a watershed, the main hydrological problems identified in Ermelino Matarazzo, the critical flooding points, and, finally, the proposed solutions for the territory, all explained through accessible visual language. In this way, the booklet functioned as a complementary instrument of public communication by translating technical

content into comprehensible and socially situated formats, reinforcing residents' understanding and expanding the circulation and legitimacy of the knowledge produced through the participatory process.[13]



Figure 4. Popular Summary "The River Is My Neighbor?", (2025). Source: authors

CONCLUSION

We seek to demonstrate the centrality of interaction, communication, and visual mediation as preconditions for effective social participation in decision-making, showing that the institutionalization of participatory processes is insufficient when asymmetries in language, repertoire, and access to technical information persist. In this sense, instruments, such as maps, illustrations, animations, and other visual resources, were developed by the Real-World Laboratories. In the case of the Itaim Paulista LAB, these resources played a strategic role in making local demands intelligible to the government by preparing technical documents grounded in local perceptions of key urban problems. In the case of Ermelino Matarazzo, the opposite operates: hydrological processes and infrastructure solutions, usually abstract for the non-specialized public, are translated into clear and accessible language, contributing to reducing informational asymmetries and expanding the capacity of residents to engage in the institutional channels of participatory planning in the city of São Paulo and strengthening the legitimacy of the democratic planning instruments provided for in the legislation Brazilian. In addition to the short-term results, the Ermelino LAB's experience points to the need for future investigations to evaluate the medium- and long-term impacts of co-production processes on urban planning. Aspects such as the effective incorporation of the proposals into the public policy cycle, social adherence to the implemented works and the reduction of conflicts during the execution of the interventions are relevant dimensions to be monitored.

By highlighting how practices of knowledge mediation and methodological adaptation are fundamental to operationalizing this approach in peripheral contexts of the Global South, this approach expands the understanding of RWLs beyond stable institutional environments and reinforces their potential as devices for urban governance and social learning in a conflictual world. The set of actions outlined reveals that transforming city planning paradigms, connecting cultural systems, public policies, planning, infrastructures, and natural cycles requires time, commitment, and, above all, new forms of relationship between technical knowledge, the university, and local knowledge. The experience of the RWLs in Itaim Paulista and Ermelino confirms that such transformations are possible when co-production, accessible language, and methodological innovation are placed at the center of practice. This is a promising path to consolidate more democratic, resilient management models rooted in local urban cultures.

NOTES

[1] This chapter results from the Real-World Laboratories (RWLs) developed within the Klimapolis project and later consolidated through the Brazilian National Institute of Science and Technology (INCT) Klimapolis. Implemented in the city of São Paulo, these laboratories were conceived as experimental, participatory platforms to address the intersections of urban governance, planning, and climate resilience in socially and environmentally vulnerable territories. By bringing together researchers, public authorities, and local actors, the laboratories sought to foster dialogue, mutual learning, and the co-production of knowledge oriented toward sustainable urban transformation.
[2] Isabel Ruiz-Mallén, "Co-Production and Resilient Cities to Climate Change," in *Participatory Research and Planning in Practice*, ed. Janez Nared and David Bole, The Urban Book Series (Cham: Springer International Publishing, 2020), 1–11, https://doi.org/10.1007/978-3-030-28014-7_1.
[3] Jakub Galuszka, "What Makes Urban Governance Co-Productive? Contradictions in the Current Debate on Co-Production," *Planning Theory* 18, no. 1 (February 2019): 143–60, https://doi.org/10.1177/1473095218780535.
[4] Gilbert Siame and Vanessa Watson, "Co-Production and the Issue of Urban up-Scaling and Governance Change in the Global South: The Case of Uganda," *Planning Theory* 21, no. 3 (August 2022): 269–90, https://doi.org/10.1177/14730952221076601.
[5] Christine Wamsler, "From Risk Governance to City–Citizen Collaboration: Capitalizing on Individual Adaptation to Climate Change," *Environmental Policy and Governance* 26, no. 3 (May 2016): 184–204, https://doi.org/10.1002/eet.1707.
[6] Daniel Black et al., "Overcoming Systemic Barriers Preventing Healthy Urban Development in the UK: Main Findings from Interviewing Senior Decision-Makers During a 3-Year Planetary Health Pilot," *Journal of Urban Health* 98, no. 3 (June 2021): 415–27, https://doi.org/10.1007/s11524-021-00537-y.
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[8] Niko Schäpke et al., "Jointly Experimenting for Transformation? Shaping Real-World Laboratories by Comparing Them," *GAIA - Ecological Perspectives for Science and Society* 27, no. 1 (January 2018): 85–96, https://doi.org/10.14512/gaia.27.S1.16.
[9] Edilia Castellanos and Maria F. Lemos, "Central and South America," in Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change, ed. H.-O. Pörtner et al. (Geneva: Intergovernmental Panel on Climate Change, **2023**), 1763–1764, https://www.ipcc.ch/report/ar6/wg2/.
[10] Angelica Alvim, Pedro Roberto Jacobi, and Andresse Lopes Marques, "Mudança Climática e o Futuro Das Cidades e Regiões: Um Chamado à Ação," in *Caderno de Propostas – Observatório Das Metrópoles Nas Eleições: São Paulo. Caderno de Propostas – Observatório Das Metrópoles Nas Eleições* (Rio de Janeiro, RJ: Letra Capital Editora Ltda, 2024), 116–23.
[11] Martin Kohler et al., "Thinking Urban Transformation through Elsewhere: A Conversation between Real-World Labs in São Paulo and Hamburg on Governance and Practical Action," *Sustainability* 13, no. 22 (November 2021): 12811, https://doi.org/10.3390/su132212811; Ana Paula Koury and Alessio Mazzaro, "Contingent Unsustainable Urban Futures in São Paulo's Peripheries," in *Contingencies in Urban Future-Making: Pitfalls, Potentialities, and Transformative Practices.* (Transcript Verlag; The Hague: JOACHIM THIEL, et al, 2025), 349–71.
[12] Fabio Sgroi, "Deu Pra Entender Ou Quer Que Eu Desenhe? A Pedagogia Pela Imagem Como Uma Abordagem Socioambiental Da Cidade," *SÃO PAULO*, 2019.
[13] John Forester, *The Deliberative Practitioner: Encouraging Participatory Planning Processes* (Cambridge, Mass: MIT Press, 1999).

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APPLICATION OF BIOMIMICRY DESIGN SPIRAL TO STUDIO

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INTRODUCTION

Architecture is at a critical point regarding how it deals with environmental problems. We can continue to attempt to solve these problems with the same method we used in the twentieth century, industry and technology, causing further harm. Alternatively, we can look at the design of the very thing we are trying to help -- the natural environment. Learning from nature and applying it to human design is the essence of biomimicry. This paper describes solutions that proved helpful in teaching biomimicry to undergraduate architecture students in a studio setting. Teaching architecture students how to design with biology as inspiration proved more difficult than anticipated. In the class, we explore how a building could function like a natural organism, deeper than form only. The difficulty was in the time needed to comprehend what the organism does to solve the problem the students defined. The first solution was to utilize the Biomimicry Design Spiral, created by the Biomimicry Institute. Another solution was to put the students in Taxonomy Teams for the early phases. Adapting these solutions has improved the teaching and the outcome of the Biomimicry + Architecture lecture class and Experimental Option Studio. For example, this past semester in Studio, we spent more time on prototyping and testing design solutions. The beginning phases were able to not only go smoothly but took less time. One step to improve the course would be to involve scientists as guest lecturers and reviewers. This could help students understand the natural environment they are interested in protecting.

Clarification

In teaching biomimetic architecture for fifteen years, the definition of what it is, how it is different from similar approaches, and why it is important to teach are foundational questions to answer. Biomimicry is the most widely-known and therefore most used term. It became popular due to a book of the same title by Janine Benyus. She defines biomimicry as the conscious emulation of life's genius.[1] The term was first used in 1969 by Otto H. Schmitt, a biophysicist at the University of Minnesota. He coined the term "biomimetic" to describe the devices he created that mimicked natural systems.[2] Bionic is a closely related term that focuses on engineering. Bio-inspired is the term used in the studio described below. It is closely related to the term biomimicry though not as recognized, which is the reason "biomimicry" was used for the title of this paper. To mimic denotes copying nature and the studio was more inspired by nature's design solutions in addressing architectural problems. The specific terminology highlights the importance of understanding the principles and functions of natural designs, rather than merely copying their forms.[3]

Each of these terms, biomimicry, biomimetic, bionic, and bio-inspired, have similar meanings and are often used interchangeably. They can be confused with terms that have different meanings, however. Biophilia was a term made popular by biologist Edward O. Wilson. It describes the human drive to connect with nature.[4] Bioutilization describes the process of using biologically derived materials or the services of living organisms in a design product, process, or system.[5] Biomorphic refers to forms or images that evoke naturally occurring forms.[6] Each of these are exciting realms for the students to study, but their differences from biomimicry are important to clarify.

Why teach bioinspired studio

Research suggests that architecture students desire to learn about sustainable solutions in their education.[7] They are looking for methods to design buildings and cities that work with, rather than against the natural environment. Why not be inspired by and learn from the very thing they are looking to protect? The popularity of nature-focused movements has increased in recent decades.[8] Teaching students to be curious is an important aspect of architectural education. Frei Otto was curious to know what nature is.[9] Bioinspired design gives students a vast arena to be curious about. How do geckos walk on glass? What is the purpose of tree bark? How do plants breathe? Questions like these are of a child-like quality but also teaching them to be curious about finding the answers they seek. Architects also seek beauty. The award-winning architect, Peter Zumthor, says that the beauty of nature touches us as something great that goes beyond us.[10] Also, our understanding of nature and our impact on it has grown exponentially. This advanced knowledge caused the environmental leader, William McDonough, to state that nature does not have a design problem; people do.[11] Why aren't we teaching students more about the design of nature? What changes in science can influence architecture? Looking to nature also creates a new design ethos that causes architects to think differently about their buildings.[12] How are they designed? How are the materials produced? What happens at the end of its use? There are many correlations between nature and architecture that show how connections can be made. DNA is the blueprint; the genetic code of any organism. Cells have the ability to read this code. This is like the set of blueprints created by architects with the "code" for contractors to build from.[13] So much of our world is focused on technological advances. One of the great technological innovators of the twentieth century, Steve Jobs, predicted that the intersection of biology and technology will be the biggest innovation of the twenty-first century.[14] Today's students are entering this new era.

Past and contemporary examples

Scientists see their work as "standing on the shoulders of giants" even when creating revolutionary breakthroughs. They understand their research and innovations are based on great minds who have gone before them. Architecture is no different even though many do not carry the same ethos. Biomimetic architecture seems new and innovative, but we too are standing on the shoulders of giants. Proportions and structures of the Greeks were inspired by nature. Leonardo da Vinci's drawings and writings are full of his observations of nature. Incorporating nature can be seen in the work of Antonio Gaudi and the Art Nouveau in the late 1800s. Gaudi was influenced by the biological studies and images of Ernst Haeckel being published during Gaudi's formative years.[15] Frei Otto's and Buckminster Fuller's designs of lightweight structures were greatly influenced by scientific discoveries in the 1960s.[16] Fuller's time at Princeton converged with Victor and Aladar Olgyay who were design scientists also at Princeton.[17] These giants paved the way for contemporary architects like Santiago Calatrava and Norman Foster to see inspiration in nature for their innovative designs.



Figure 1. Organic forms of Gaudi's Sagrada Familia

TOOLS AND ADAPTATIONS

These nature inspired architects are researched by the students in the Biomimicry + Architecture lecture course taught since 2017. It has proven helpful for the students to see how they are advancing ideas of the past and laying the foundation for future work. This has helped to show that biomimetic design is not a passing trend but has real world solutions that connect architecture to nature. The solutions they are seeking with their sustainability focus. To aid in finding these solutions, we have utilized the Biomimicry Design Spiral created by the Biomimicry Institute. The steps are intended to be a helpful tool in learning steps for the biomimetic design process.[18]

Studio Modifications

The lecture course was adapted to an Experimental Option Studio that also started by using this Biomimicry Design Spiral. While the Spiral has proven helpful in explaining steps in a lecture class setting, modifications were made in a studio course. In the Define stage, each student listed a current problem they see with architecture. For the Studio, we focused on building skins to give specificity to the research and solutions. Next, the students framed these design challenges using biological terms in the Biologize (Depict) phase. It is crucial here to research the functions and contexts of their architectural challenge, getting to the essence of the problem. Researching natural organisms was done in the Discover phase. The information compiled was then translated back into architectural strategies during the Abstract (Decipher) step. Here the students created multiple diagrams, and they were glad to get back to what they were used to doing after spending time in the unfamiliar territory of the sciences. The Emulate (Design) phase was also familiar to them as they were used to designing ideas for class projects. Keeping students from jumping to this phase too early was a challenge as it was important to keep them in the early phases to give direction to their concepts. Evaluate (Decide) is the final step in this process. Here the students would test how their designs met their goals in solving the defined problem. The steps remained the same in principle, but phase titles were changed

as was the amount of time spent in each phase for Studio. In the lecture class, most of the time was spent on the first four phases, with an emphasis on initial research and discovery. The studio spent the most time on the last two phases as shown in Figure 2. The same initial research was done as in the lecture course, but it was accelerated and refined and tested in the Design and Decide phases.

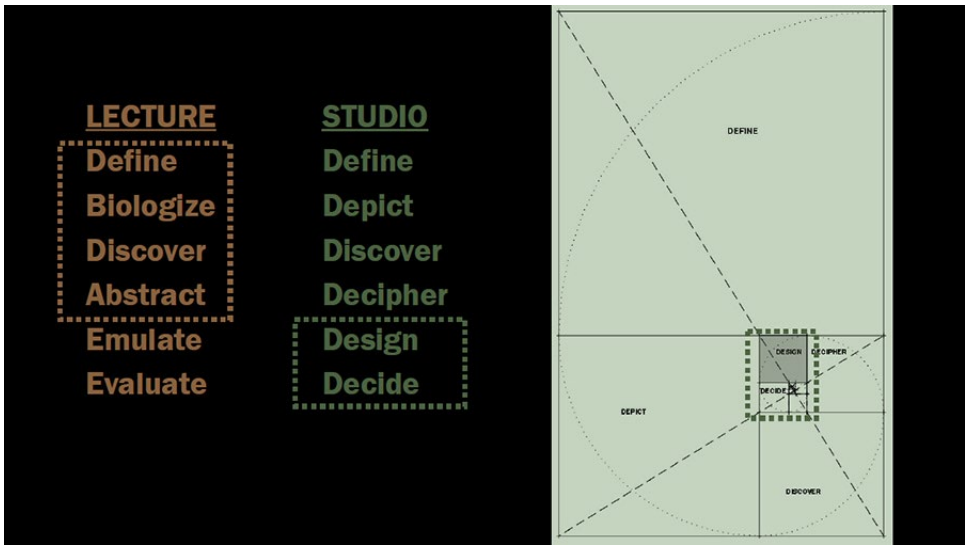


Figure 2. Biomimicry Design Spiral modifications

SCIENTIFIC APPROACH

These last two phases, Design and Decide, provided the Studio students with an opportunity to test their designs as ongoing research. This closely followed the scientific method. Each student proposed a design solution, their hypothesis, and then utilized experiments and evidence-based reasoning to test their designs. More on this methodology is described below. The process taught was influenced by Julian Vincent, Professor of Biomimetics at Bath University, and his challenge for architects to learn the principles of natural structures, not just outward forms.[19]

Team Taxonomy

During the early research phases, the studio took another scientific method to aid in the process. We created teams by using a taxonomy method. Taxonomy is utilized in science to classify and categorize organisms. As the students were defining the architectural problems they wanted to solve and discovering organisms that also solved those problems, it became helpful to create a Team Taxonomy. This allowed students to share resources on problems as well as literature on natural organisms, which accelerated these beginning phases. Teams were organized by the problems they were solving to begin with. Once the feedback within these teams helped to focus on the essence of the problem, each student selected two organisms that solved this problem. These organisms were placed in a taxonomy according to flora (trees and plants) and fauna (air, land, and water). Not only was it interesting to see which organisms the groups were leaning towards, but it provided much more overlap of scientific research than if the work had been just on an individual level. This Team Taxonomy is shown in the overall structure in Figure 3. The organisms being explored in relation to the architectural problem groups are shown in Figure 4.

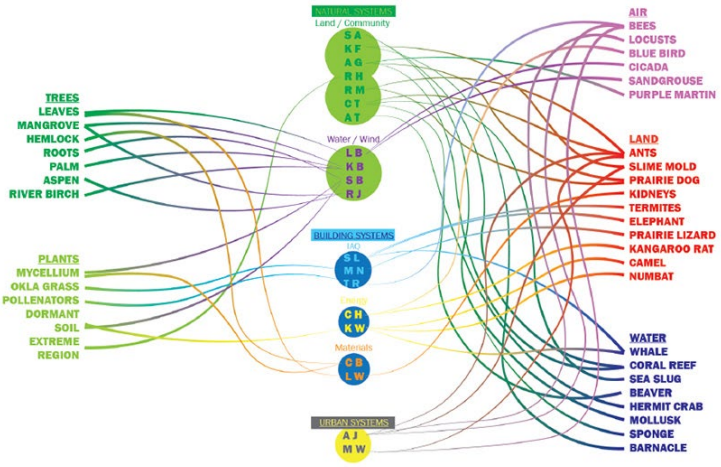


Figure 3. Team Taxonomy overall



Figure 4. Team Taxonomy groups and organisms

Comfortable with Failure

The mantra of "fail fast, fail often" was utilized by entrepreneurs to encourage innovation and not let failure be seen as bad.[20] This has been criticized from a business standpoint because the failures are often big. In scientific experiments, failure is a major part of the process, but it is not seen as bad, because the early experiments are small failures. They reassess their hypothesis by asking what the experiment is telling them.[21] So for Studio, we combined these concepts into a new mantra to fail small, fail fast, fail early. It didn't mean to keep making the same mistakes but encouraged the students to quickly come up with an idea and test it. The students documented their failures as part of the process which were included in their final booklet. An example of this documentation and research is shown in Figure 5.

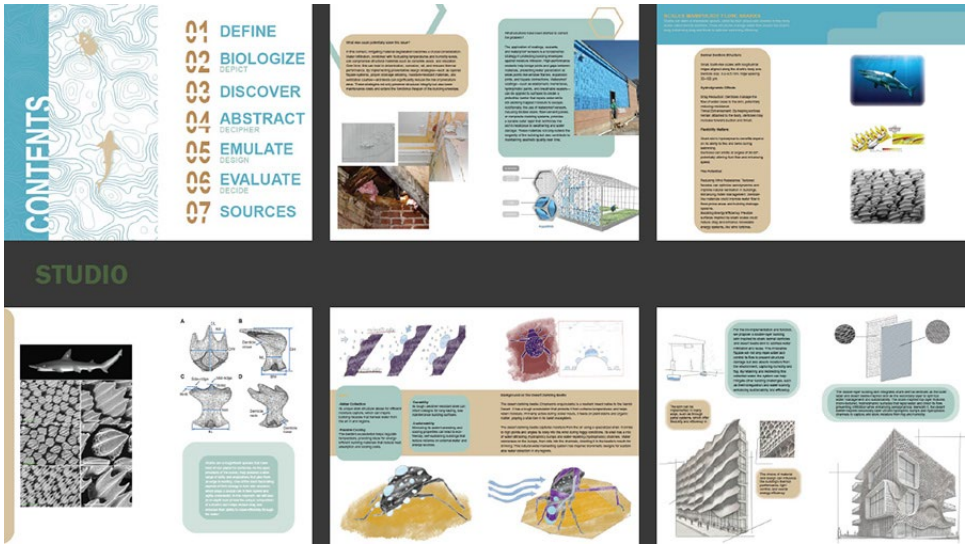


Figure 5. Booklet documentation of early phases

Prototyping

Rapidly creating combined with testing and retesting was done through prototyping an idea quickly. In the beginning of the process, these prototypes were made from inexpensive, easy to modify materials. Manilla folders, chopsticks, and duct tape were common materials in these early prototypes. To test moisture and ventilation on study models, students used small portable misters. As the prototypes became more finalized, 3d printing in studio was utilized. This allowed for creating small components quickly, seeing how they performed, adjusting the design, and printing it again. These small and rapid iterations and tests often happened in a single studio setting. Figures 6 and 7 show examples of this prototyping and testing process.

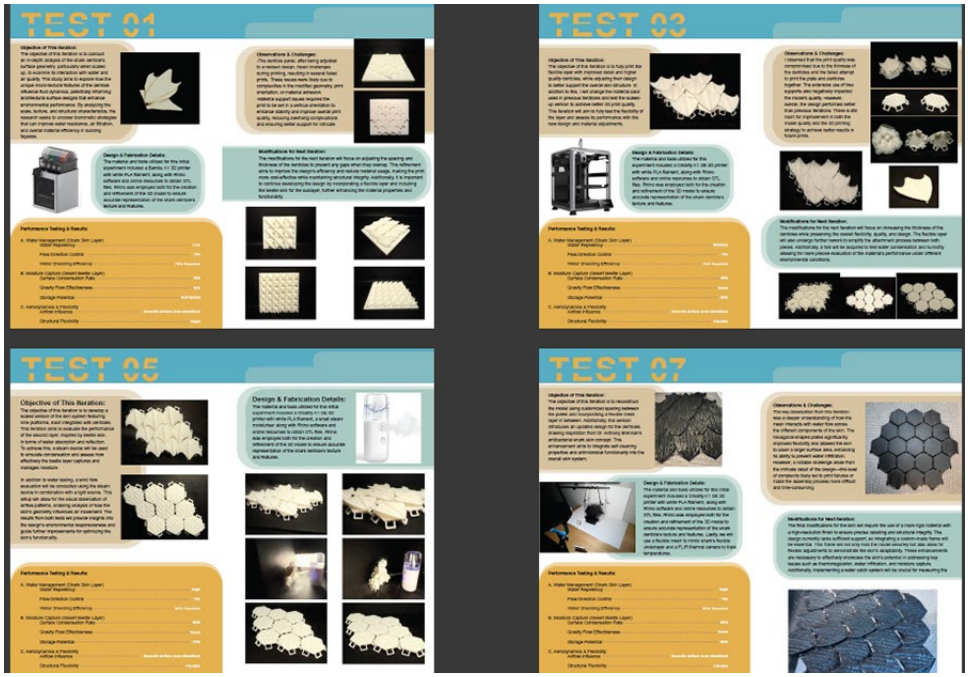


Figure 6. Prototyping example -- booklet excerpts

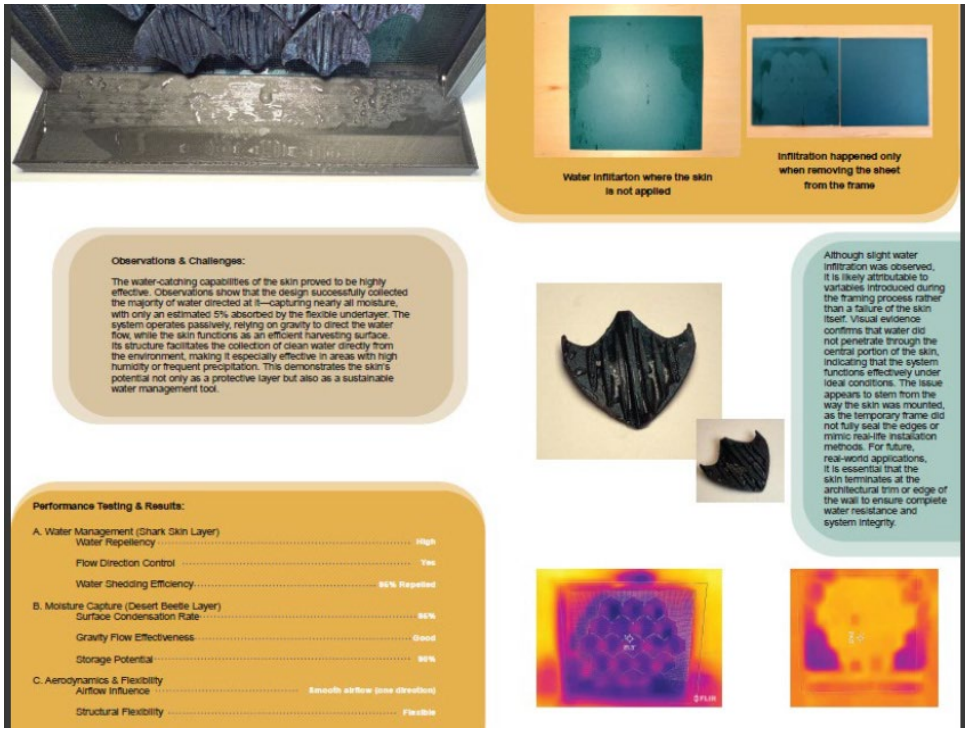


Figure 7. Testing example -- booklet enlargement

CONCLUSION

These additions and modifications to the process in a studio setting proved fruitful. They allowed the students to get further along with their design ideas which resulted in better solutions. Better in the sense that they more accurately addressed the original problem they defined. Students' project ideas in the lecture class were initial concepts; a proposal that needed further development. The above-mentioned steps gave those students in studio more time and rigor to develop their concepts. Those students who had taken the lecture course prior to studio used the problem and project idea defined in the lecture class project. They hit the ground running and were valuable in assisting other classmates in the process. One of the future changes to the studio would be to make the Biomimicry + Architecture lecture class a requirement. Another way to improve will be to involve science professors in the process. They could give early lectures on how they use the scientific method, overcome failure, and document experiments. Each professor could then consult with students' groups with regards to their area of expertise. This interdisciplinary work would culminate in having these science professors participate in reviews of student work. Adding these scientists as consultants will further help students understand the natural environment they are working to protect. Which will give them the tools to deal with the environmental problems facing architecture. Our buildings could learn from nature whose design, as D'Arcy Thompson notes, strives to make structures using the least amount of energy and materials.[22] Wouldn't it be good to say the same of our buildings?

NOTES

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[12] Yael Halfman Cohen, *Wild Ideas: How Nature Inspires Groundbreaking Innovations*, (Coppell, TX: eBookPro Publishing, 2024), 52.
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[20] Rory Carrol, "Silicon Valley's culture of failure… and 'the walking dead' it leaves behind," *The Guardian*, June 28, 2014, accessed January 3, 2024, https://www.theguardian.com/technology/2014/jun/28/silicon-valley-startup-failure-culture-success-myth.
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MEASURABLE AND UNMEASURABLE ASPECTS IN DESIGN: UNDERSTANDING TANGIBLE AND INTANGIBLE DIMENSIONS THROUGH URBAN PUBLIC SPACES IN HYDERABAD

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INTRODUCTION

Architectural design is a synthesis of the measurable and the immeasurable, where the tangible intersects with the experiential. Quantitative aspects define the physical, measurable parameters of space—size, dimension, lighting, acoustics, and thermal performance—while qualitative aspects pertain to human perception, emotional response, and cultural meaning). Both are indispensable to understanding the holistic nature of architectural space.

In contemporary design discourse, measurable attributes are often prioritized due to advances in digital modelling, energy performance simulation, and building information modelling (BIM). However, architecture's enduring value lies in its capacity to evoke experience—how users feel, remember, and identify with spaces.[1] The neglect of these qualitative dimensions has led to a growing gap between technical optimization and human experience. This paper aims to bridge that gap by analysing both quantitative and qualitative aspects of selected urban public spaces in Hyderabad.

Through this inquiry, it seeks to address key questions:

- How do measurable and unmeasurable aspects shape spatial experience?
- What is the relationship between environmental performance and user perception?
- How can design education incorporate both modes of understanding?

Theoretical Foundations: Quantitative and Qualitative Dimensions of Space

The discourse on architectural space has long oscillated between the quantitative—that which can be measured and objectively analyzed—and the qualitative, which encompass perception, emotion, and meaning. Historically, architectural education emphasized proportion, geometry, and structural logic, grounded in Vitruvian principles of firmitas, utilitas, and venustas.[2] While firmitas and utilitas correspond to measurable parameters of strength and functionality, venustas—beauty—belongs to the realm of qualitative experience. This duality continues to inform architectural thinking.

In the modern era, the quantitative dimension gained predominance with the rise of scientific rationalism and technological progress. Architectural modernism prioritized function, standardization, and performance efficiency, seeking universality through measurable parameters.[3] Yet, critics such as[4] and [5] argue that this approach risks alienating the human experience by neglecting the sensory and emotional engagement that gives architecture its meaning. According to Pallasmaa, "the door handle

is the handshake of the building," symbolizing the deep sensory connection between body and space. Thus, while the measurable defines the framework, the immeasurable defines the essence.

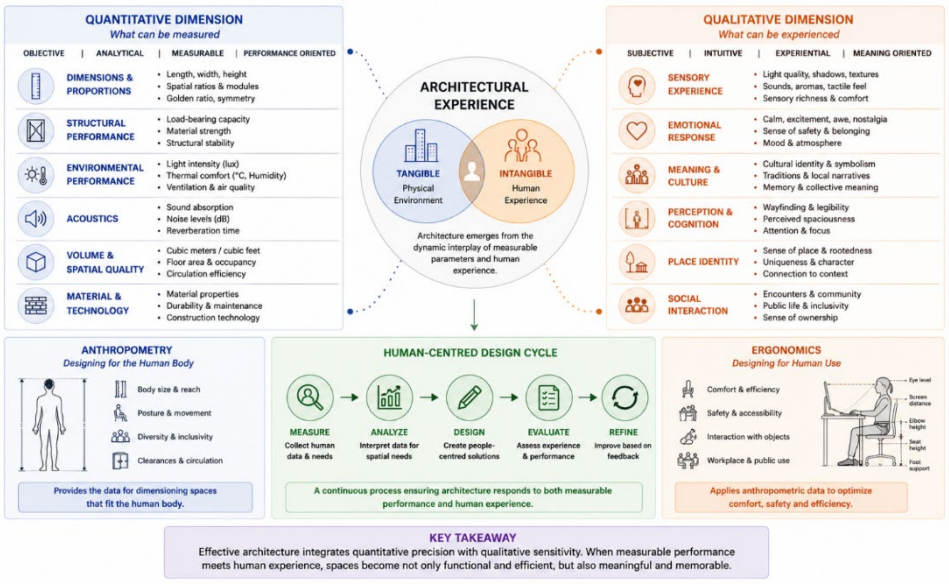


Figure 1. Quantitative and Qualitative Dimensions in Architecture. Balancing measurable performance with human experience

Quantitative Aspects in Architecture: Metrics of Performance and Function:

Quantitative aspects of architecture pertain to parameters that can be measured, compared, and optimized. These include dimensions, proportions, volume, light intensity, thermal comfort, acoustics, and structural stability.[6] Quantification enables architects to ensure safety, accessibility, and performance standards within a design. Anthropometry and ergonomics are foundational quantitative disciplines that bridge the gap between human needs and spatial configuration.

Anthropometry, derived from the Greek words *anthropos* (human) and *metron* (measure), involves the study of human body measurements to inform design.[7] It ensures that spatial configurations accommodate the diversity of human sizes, postures, and movement patterns. Anthropometric considerations are evident in determining door heights, furniture dimensions, or circulation widths—parameters that make spaces inclusive and usable.

Ergonomics, closely related, extends anthropometric data to optimize the relationship between people and their environments. It studies how spatial layouts, furniture, and tools can enhance comfort, efficiency, and safety.[8] In architecture, ergonomic design manifests in workplace planning, public furniture design, and urban accessibility measures. Together, anthropometry and ergonomics ensure that measurable parameters align with human physical needs.

Quantitative evaluation also includes environmental performance—such as daylight levels, temperature gradients, ventilation rates, and acoustic comfort. These are measured using tools like lux meters, thermometers, and decibel meters. Thermal comfort, for example, can be quantified using indices such as the Predicted Mean Vote (PMV) model.[9] Such parameters directly influence user satisfaction and productivity, confirming that the measurable aspects of space are integral to human well-being.

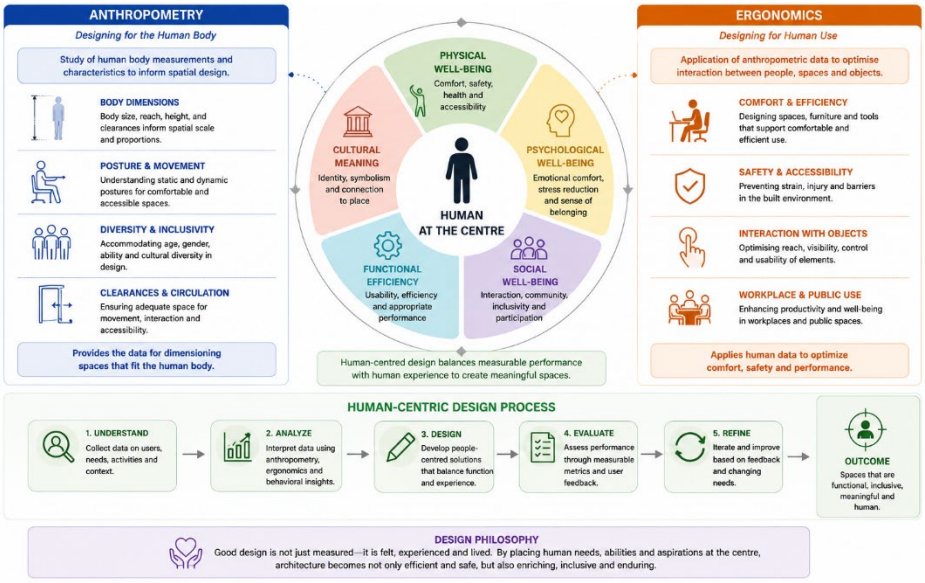


Figure 2. Human-centric design framework – Integrating Anthropometry, Ergonomics and Design process.

Qualitative Aspects: The Experiential and Phenomenological Dimension

While quantitative aspects establish the framework of space, qualitative aspects define its experiential depth. The phenomenological approach to architecture—pioneered by thinkers like,[10] and[11] - emphasizes perception, sensory experience, and emotional resonance. Norberg-Schulz's notion of *Genius Loci* (the spirit of place) highlights how spaces acquire meaning through cultural, historical, and environmental context. Similarly, Holl's writings on "anchoring" and "intertwining" propose that architecture derives its essence from sensory engagement—light, materiality, color, and movement.

According to Pallaasma, architecture is experienced through the body and the senses rather than through the eye alone. The smell of materials, the sound of footsteps, or the texture of surfaces all contribute to what he calls the "multi-sensory realm" of architecture. These aspects, though unmeasurable, are essential to creating memorable and humane spaces.[12] reinforces this by describing architecture as "experienced dynamically," suggesting that perception unfolds through time, movement, and interaction rather than static observation.

Qualitative dimensions also encompass psychological, cultural, and social factors. Psychological comfort arises when spatial design supports mental ease, safety, and belonging.[13] Cultural and historical significance relates to the symbolic and emotional associations users form with space—often shaped by memory, heritage, and identity. Similarly, social significance refers to how architecture fosters interaction, inclusion, and a sense of community.[14] Together, these aspects underscore that the value of architecture lies not merely in its measurable performance but in its capacity to shape lived experience.

Interrelation between the Measurable and the Immeasurable

Despite being conceptually distinct, quantitative and qualitative aspects are deeply interdependent. The measurable sets the conditions for the unmeasurable to emerge. For instance, the width of a corridor (quantitative) affects the sense of openness or intimacy (qualitative); daylighting levels (quantitative) influence mood and perception of warmth (qualitative); and material choices (quantitative specifications) affect tactile comfort and aesthetic character (qualitative experience). As Holl notes, architecture achieves harmony when "the measurable and the immeasurable meet."

Recent scholarship in environmental psychology and evidence-based design has attempted to quantify some qualitative experiences. For example, studies correlate daylight with emotional well-being [15] or spatial layout with perceived safety.[16] Yet, the complexity of human experience resists full measurement, reaffirming that architecture operates across both tangible and intangible dimensions.



Figure 3. Architectural harmony and urban public spaces – Creating meaningful, inclusive and liveable spaces.

Urban Public Spaces as Sites of Interaction

Urban public spaces represent ideal contexts for examining this interaction. They are multifunctional, socially diverse, and environmentally dynamic. Scholars like[17] emphasize that successful public spaces balance comfort, safety, aesthetics, and inclusivity—bridging quantitative performance (walkability, lighting, spatial configuration) with qualitative experience (vitality, belonging, emotional attachment). In the context of Indian cities like Hyderabad, this balance is crucial, as climatic constraints, cultural diversity, and rapid urbanization shape both the physical and experiential character of public spaces.

Thus, understanding architecture through both measurable and unmeasurable lenses not only enriches design methodology but also grounds it in human experience. It encourages a synthesis between the scientific and the sensory, between what can be diagrammed and what must be felt—a philosophy that guides the methodology and case study analysis of this research.

METHODOLOGY

This study adopts a mixed-method design research approach, integrating quantitative analysis of spatial and environmental parameters with qualitative interpretation of user experience and perception. The approach recognizes that architectural space operates simultaneously as a physical construct and an experiential phenomenon. Therefore, a combination of analytical measurements and phenomenological observations was employed to explore the interplay between measurable and unmeasurable aspects of urban public spaces in Hyderabad.

Following[18] design research in architecture demands both empirical rigor and interpretive insight. Quantitative data provide evidence of spatial and environmental performance, while qualitative data capture emotional, cultural, and sensory responses that cannot be reduced to numerical values. This

methodological synthesis enables a more holistic understanding of space, bridging the objective and subjective dimensions of architectural experience.

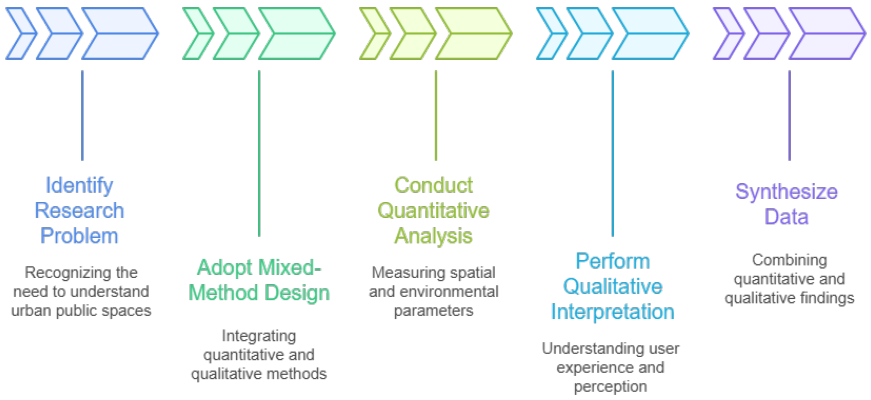


Figure 4. Research Methodology

Research Questions:

The study is guided by the following central question:

• How do measurable (quantitative) and unmeasurable (qualitative) aspects coexist and influence user experience in urban public spaces of Hyderabad?

Supporting sub-questions include:

1. What quantitative spatial and environmental parameters contribute to comfort, usability, and accessibility?
2. How do users perceive and emotionally respond to these spaces, and what intangible factors shape their sense of belonging and attachment?
3. How can architectural analysis reconcile performance-based evaluation with experiential interpretation?

Case Study Selection:

To explore these questions, **five urban public spaces in Hyderabad** were selected based on diversity in typology, scale, and function:

1. **Cha Cha Nehru Park**, Banjara Hills – a neighbourhood recreational park integrating landscape and play areas.
2. **Jalagam Vengal Rao (JVR) Park**, Banjara Hills – a large-scale public garden emphasizing environmental and climatic comfort.
3. **State Central Library**, Afzalgunj – a heritage civic space representing cultural and intellectual engagement.
4. **Srishti Art Gallery**, Jubilee Hills – a semi-public cultural institution emphasizing sensory and aesthetic experience.
5. **GHMC Dog Park**, Necklace Road – a unique thematic park reflecting social inclusivity and design for non-human users.

These spaces were chosen to represent varied **programmatic, environmental, and experiential** conditions within Hyderabad's urban context.

Quantitative Methods

Quantitative data were collected to assess **spatial, environmental, and ergonomic** attributes of each site. The following tools and measures were used:

- **Spatial Documentation and Mapping**: Site plans and sectional drawings were prepared to record scale, dimensions, and spatial hierarchy.
- **Anthropometric and Ergonomic Evaluation**: Key physical parameters such as pathway widths, seating dimensions, step heights, and accessibility ramps were compared against standards from *Neufert's Architects' Data* [19] and ECBC urban design guidelines,
- **Environmental Performance Analysis**: On-site measurements were taken for daylight (lux levels), temperature (°C), and sound levels (dB) using digital sensors. Observations were recorded across different times of day to identify thermal and acoustic comfort variations.
- **User Density and Activity Mapping**: Quantitative activity mapping was conducted to record frequency, duration, and spatial distribution of users across zones. This method follows[20] approach to behavioural mapping in public s paces.

The resulting data provided measurable insights into how environmental performance and spatial configuration affect usability and comfort.

Qualitative Methods

Qualitative inquiry focused on understanding **experiential and perceptual dimensions** through the following methods:

- **Non-Participant Observation**: Detailed field observations captured sensory and emotional responses—smells, sounds, light quality, and social interactions. Phenomenological notes were maintained following[21] sensory framework.
- **Semi-Structured User Interviews**: 8–10 participants from each site were interviewed to understand perceptions of comfort, belonging, memory, and identity. Responses were coded thematically using [22] approach to thematic analysis.
- **Sensory and Emotional Mapping**: Participants identified zones associated with calmness, activity, or discomfort. These qualitative maps visualized the "unmeasurable atmosphere" of each space.
- **Photographic Documentation**: Visual analysis of light, materiality, and spatial transitions supplemented the phenomenological readings of each site.

Data Integration and Analysis:

The **integration of quantitative and qualitative data** was carried out using a comparative synthesis framework.[23] Measurable data such as lighting, temperature, and spatial proportions were cross-referenced with user perceptions of comfort, attachment, and atmosphere. For instance, zones with high environmental comfort (e.g., shaded pathways, moderate sound levels) were correlated with positive emotional responses, revealing the overlap between performance and perception.

The analysis was structured around three key dimensions:

1. **Physical comfort and usability** (quantitative)
2. **Emotional and cultural attachment** (qualitative)
3. **Spatial identity and atmosphere** (integrated dimension)

This mixed-method synthesis aimed to articulate how the **quantitative structure of space supports or contradicts qualitative experience**, offering design insights that transcend purely technical analysis

Case Study Analysis

Overview

Urban public spaces act as living laboratories where measurable spatial parameters intersect with unmeasurable human experiences. Each case study in Hyderabad demonstrates a unique negotiation between physical performance and sensory perception—how design decisions influence comfort, belonging, and meaning. This section presents comparative findings from **five sites**, categorized under measurable (quantitative) and unmeasurable (qualitative) dimensions, and concludes with integrative insights on spatial identity and atmosphere.

Case Study 1: Cha Cha Nehru Park, Banjara Hills

Quantitative Aspects:

Covering approximately **4 acres**, Cha Cha Nehru Park features paved walkways averaging **1.8–2.2 meters** in width, seating spaced every **15–20 meters**, and vegetation density exceeding **60% canopy cover**. Daylight measurements averaged **6,000–8,000 lux** in open areas and **2,500 lux** in shaded zones—well within the comfort range for daytime recreation.[24] Thermal readings indicated a surface temperature drop of **3–4°C** under tree canopies, demonstrating effective microclimatic regulation.

Qualitative Aspects:

Users described the space as "relaxing" and "child-friendly," attributing comfort to natural shade, acoustic softness, and visual continuity with greenery. Observations revealed multisensory engagement: rustling leaves, bird calls, and filtered light contributing to what[25] terms the "haptic calm" of space. The repetitive rhythm of benches and trees enhanced a sense of rhythm and familiarity.



Figure 5. Cha Cha Nehru park – Location & Context, Park overview, people & activities and activity mapping.

Synthesis:

The park's measurable ecological performance directly supports its unmeasurable emotional tranquillity, illustrating how environmental metrics translate into sensory experience.

Measurable / Tangible Parameter	Observed Ecological Performance	Sensory Translation	Unmeasurable / Intangible Experience	Spatial Impact in the Park
Tree canopy coverage	Reduction in surface and ambient temperature	Thermal comfort and shade perception	Calmness and physical relaxation	Comfortable seating and prolonged stay areas
Vegetation density	Improved air quality and microclimate moderation	Feeling of freshness and visual softness	Psychological restoration	Buffer zones and contemplative spaces
Noise attenuation through landscape buffers	Reduction of urban sound intrusion	Acoustic quietness	Mental relief and tranquillity	Quiet corners and shaded pathways
Permeable surfaces and soil systems	Reduced heat retention and improved water absorption	Cooler ground experience	Environmental comfort	Walkable and breathable landscape surfaces
Biodiversity (birds, insects, vegetation variety)	Enhanced ecological richness	Sensory engagement with nature	Emotional connection to environment	Nature-interaction zones
Shaded pedestrian pathways	Improved walkability and reduced heat exposure	Ease of movement	Sense of refuge and relaxation	Continuous circulation comfort
Open lawn and gathering spaces	Spatial openness and visibility	Freedom of movement and social comfort	Social belonging and emotional ease	Community interaction zones
Water features / moist landscape zones	Microclimate cooling effect	Auditory and visual calmness	Reflective and meditative atmosphere	Passive recreation areas
Seating distribution and resting nodes	Increased user occupancy duration	Physical comfort and pause opportunities	Emotional attachment and lingering behaviour	Social and contemplative nodes
Spatial enclosure through planting	Controlled visual permeability	Sense of safety and intimacy	Emotional security and refuge	Semi-private relaxation spaces

Table 1. The Park's measurable ecological performance directly supports its unmeasurable emotional tranquility, illustrating how environmental metrics translate into sensory experience

Case Study 2: Jalagam Vengal Rao (JVR) Park, Banjara Hills

Quantitative Aspects:

JVR Park spans **22 acres**, with primary walkways of **3.5–4.0 meters** wide and seating zones arranged in geometric clusters. Thermal data indicated significant cooling (average **5°C** below ambient city temperature), aided by a dense tree canopy and central water bodies. Sound level recordings ranged between **45–55 dB**, maintaining acoustic comfort according to WHO standards.

Qualitative Aspects:

Interviews revealed that visitors perceived JVR Park as "serene yet vibrant." Families and elderly users valued its "balance of openness and privacy." Phenomenological observations highlighted a sense of *temporal layering*—morning joggers, daytime families, and evening gatherings transforming the atmosphere cyclically[26] Users connected emotionally with spatial zones through habitual routes and personal memories of repeated visits.

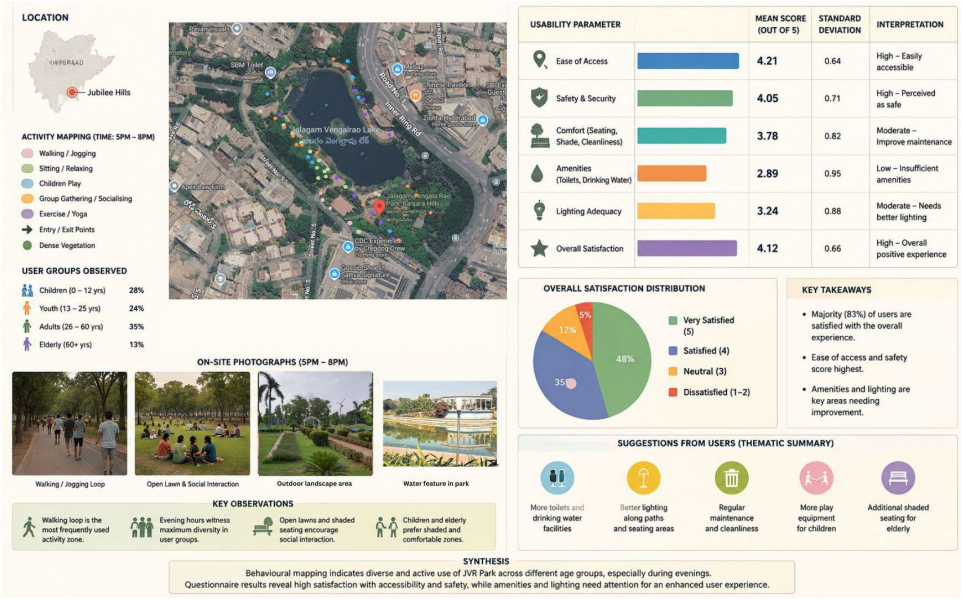


Figure 6. JVR park – Location & Context, Park overview, people & activities and activity mapping.

Synthesis:

The park's large scale and environmental optimization provide physical comfort, while spatial rhythms and habitual engagement generate continuity and attachment. This supports (Holl 1996) argument that architecture gains meaning through "lived temporality."

Case Study 3: State Central Library, Afzalgunj

Quantitative Aspects:

A heritage structure from 1891, the State Central Library features high ceilings (**6.2 –7.5 meters**), large arched windows ensuring daylight penetration of **2,000–3,000 lux**, and thermal mass that maintains indoor temperatures **2–3°C** lower than exterior readings. Spatial configuration follows classical symmetry—central atrium flanked by reading rooms—facilitating passive ventilation.

Qualitative Aspects:

Despite its aging infrastructure, users described the building as “peaceful,” “intellectual,” and “historic.” The scent of old books, filtered light, and echoing corridors evoke what[27] calls “poetics of space”—an emotional memory tied to sensory cues. Cultural memory amplifies attachment; many respondents associated the building with personal growth and academic identity.

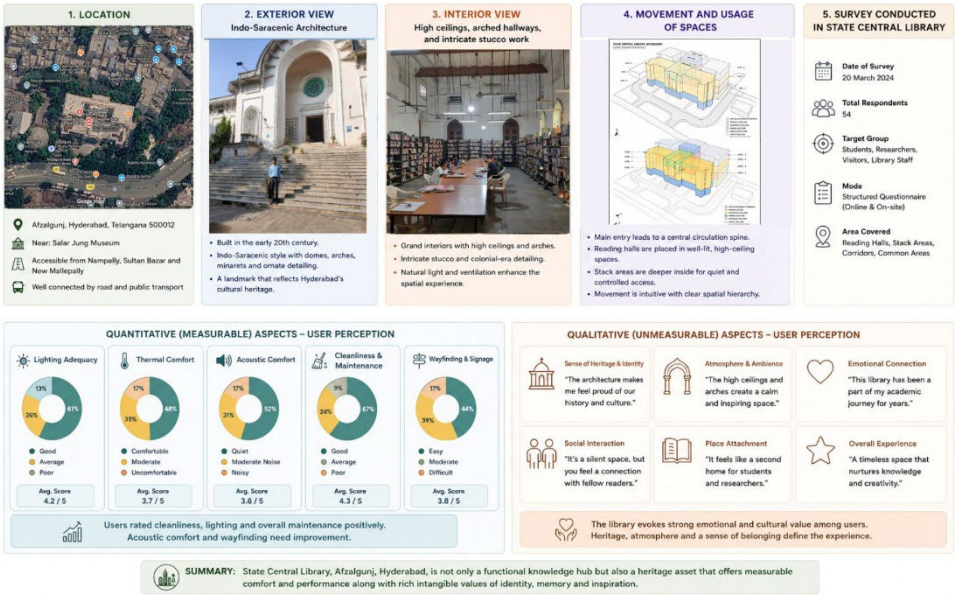


Figure 7. State Central Library, Hyderabad – Integrated Analysis of Location, Architectural Character, Spatial Experience, Movement Patterns, and User Perception

Synthesis:

Here, measurable parameters like ceiling height and material thickness produce environmental comfort, while sensory and symbolic cues yield emotional depth. The measurable and unmeasurable merge through the continuity of history and function.

Measurable / Tangible Parameter	Physical or Environmental Performance	Sensory / Symbolic Cue	Unmeasurable / Intangible Experience	Continuity Through History & Function
High ceiling height	Improved air circulation and thermal comfort	Sense of openness and vertical grandeur	Intellectual calm and spatial relief	Reflects traditional institutional architecture
Thick masonry walls	Thermal insulation and acoustic buffering	Feeling of solidity and permanence	Psychological comfort and stability	Historic construction responding to climate
Arched openings and corridors	Enhanced airflow and daylight penetration	Rhythmic movement and visual continuity	Nostalgia and timelessness	Continuity of Indo-Saracenic architectural language
Natural lighting through large windows	Reduced glare and balanced illumination	Soft daylight ambience	Contemplative and peaceful atmosphere	Historic reliance on passive environmental design
Material texture (stone, lime plaster, wood)	Durability and climatic moderation	Tactile richness and aged character	Memory association and authenticity	Preservation of historic material identity
Spatial symmetry and axial organization	Clear orientation and circulation efficiency	Formal order and harmony	Sense of dignity and institutional importance	Functional continuity of knowledge spaces
Reading hall proportions	Acoustic moderation and user comfort	Quietness and collective concentration	Intellectual immersion	Continued function as a public learning space
Courtyard or transitional spaces	Ventilation and thermal regulation	Gradual transition between inside and outside	Emotional pause and reflection	Traditional climatic response in heritage buildings
Shelf arrangement and archival organization	Efficient storage and accessibility	Visual density of books and knowledge	Reverence toward learning	Symbolic continuity of scholarship and preservation
Historic architectural ornamentation	Visual articulation and identity	Cultural symbolism and heritage recall	Emotional attachment and civic pride	Continuity of collective cultural memory
Controlled acoustics	Reduction of disturbance	Silence and auditory calm	Mental focus and introspection	Sustained functional requirement of libraries

Table 2. Measurable parameters like ceiling height and material thickness produce environmental comfort, while sensory and symbolic cues yield emotional depth.

Case Study 4: Srishti Art Gallery, Jubilee Hills

Quantitative Aspects:

Srishti Art Gallery, a semi-public cultural space, employs controlled lighting between **150–400 lux**, ideal for art viewing. The gallery's circulation follows a **loop plan** with variable ceiling heights (3.5–5.0 meters), enhancing visual dynamics. Acoustic absorption panels reduce echo, maintaining average sound levels of **35–40 dB**, supporting concentration and contemplation.

Qualitative Aspects:

Visitors expressed feelings of "immersion," "calm," and "inspiration." The tactile qualities of polished concrete floors and matte white walls foster a neutral sensory canvas, allowing art to dominate perception. Light gradients create what [28] terms "silence of space," where material restraint intensifies emotional resonance. Interviews highlighted the role of proportion and lighting in evoking introspection and focus.



Figure 8. Srishti Art Gallery, Jubilee Hills – Integrated Analysis of Location, Material Palette, Lighting Conditions, and Acoustic Environment.

Synthesis:

The measurable precision of lighting, proportion, and acoustics is inseparable from the unmeasurable sense of contemplation. Here, architecture mediates between the functional and the poetic, validating[29] claim that architecture is "the masterly, correct, and magnificent play of masses brought together in light."

Design Dimension	Measurable (Tangible) Aspects	Possible Indicators / Parameters	Unmeasurable (Intangible) Aspects	Spatial Experience / Interpretation
Lighting Quality	Lux levels, natural light penetration, glare control, contrast ratio	Daylight factor, illumination intensity, window-wall ratio	Sense of contemplation, calmness, artistic focus	Light enhances reflective engagement with artworks and spatial depth
Spatial Proportion	Room dimensions, ceiling height, circulation width, visual axis	Human scale ratio, proportion systems, viewing distance	Perception of harmony and balance	Spatial composition creates psychological comfort and aesthetic coherence
Acoustics	Reverberation time, sound absorption, ambient noise levels	Decibel levels, material absorption coefficients	Quietude, concentration, meditative atmosphere	Acoustic control supports immersive artistic experience
Material Expression	Surface texture, reflectivity, thermal properties	Material finish, durability, tactile quality	Emotional warmth and sensory connection	Materials contribute to sensory richness and experiential identity
Circulation & Movement	Path width, accessibility standards, spatial sequencing	Movement patterns, entry-exit nodes	Curiosity, anticipation, discovery	Sequential movement shapes narrative engagement with the gallery
Light and Mass Relationship	Distribution of solid and void, shadow patterns	Built-open ratio, shadow analysis	Poetic perception of space	Architecture becomes an experiential "play of masses brought together in light"
Visual Connectivity	Sightlines, transparency, focal points	Visibility index, frame composition	Sense of openness and contemplation	Visual continuity strengthens engagement between user, art, and space

Table 3. The measurable precision of lighting, proportion, and acoustics is inseparable from the unmeasurable sense of contemplation.

Case Study 5: GHMC Dog Park, Gachibowli

Quantitative Aspects:

India's first municipal dog park spans **1.3 acres** with designated zones for small and large breeds. Design parameters include **fencing height (1.2 m)**, **paved run tracks (2 m width)**, and **equipment spacing (3–5 m)** for agility and safety. Average ground temperature remained **2°C cooler** in shaded play areas due to pergolas and tree coverage.

Qualitative Aspects:

Observations revealed an atmosphere of *community inclusivity*—humans and pets sharing spatial ownership. Users described the park as "unique" and "liberating." Emotional responses extended beyond physical comfort to social well-being, reflecting[30] idea of "social space" as a lived, negotiated

construct. The laughter of owners, interactions between strangers, and playfulness of dogs contribute to a multisensory social vibrancy that cannot be measured but is deeply felt.

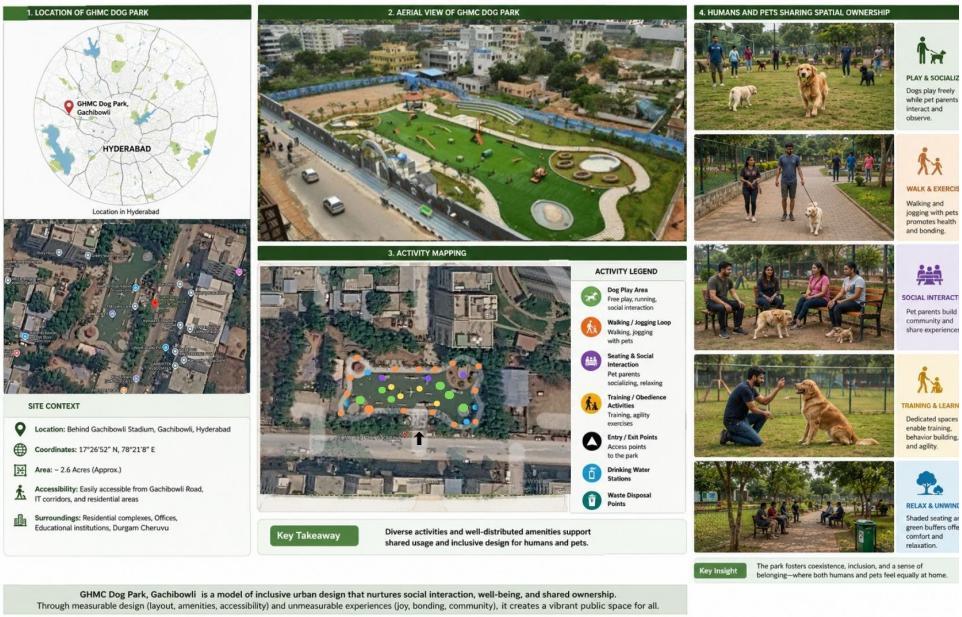


Figure 9. GHMC Dog Park, Gachibowli: Location, Spatial Ownership and Activity Mapping.

Synthesis:

Here, measurable aspects—safety dimensions, shade ratios, and spatial zoning—enable the qualitative emergence of freedom, social connection, and belonging. The park becomes a model for inclusive, empathetic urban design.

Design Dimension	Measurable (Tangible) Aspects	Possible Indicators / Parameters	Unmeasurable (Intangible) Aspects	Spatial Experience / Interpretation
Safety & Accessibility	Fence height, pathway width, lighting levels, entry control	Safety standards, visibility range, accessibility compliance	Sense of security and comfort	Safe spatial design encourages relaxed interaction among users and pets
Shade & Thermal Comfort	Tree canopy cover, shaded seating area, surface temperature	Shade ratio, temperature variation, green cover percentage	Physical ease and prolonged engagement	Comfortable microclimate enhances social gathering and user retention
Spatial Zoning	Separation of play, seating, and circulation areas	Area allocation, activity mapping, user density	Freedom of movement and inclusivity	Clearly defined zones support diverse user behavior without conflict
Seating & Interaction Spaces	Number and distribution of seating elements	Seating capacity, proximity to activity zones	Social connection and community bonding	Spatial arrangements foster interaction among pet owners and visitors
Landscape Elements	Lawn coverage, planting density, softscape-hardscape ratio	Green area percentage, biodiversity indicators	Emotional attachment and relaxation	Natural elements contribute to restorative urban experiences
Circulation & Movement	Path hierarchy, walking loops, accessibility routes	Movement flow analysis, path connectivity	Exploration and active engagement	Circulation patterns encourage dynamic use of the park environment
Human–Animal Interaction Design	Play equipment dimensions, open play areas, visibility	Activity frequency, interaction zones	Empathy, belonging, companionship	Design supports emotional bonds between users, pets, and community
Inclusive Urban Environment	Universal access features, multi-user accommodation	Barrier-free access, inclusive infrastructure	Sense of belonging and shared ownership	The park functions as an inclusive public realm promoting social cohesion

Table 4. measurable aspects—safety dimensions, shade ratios, and spatial zoning—enable the qualitative emergence of freedom, social connection, and belonging.

Comparative synthesis across five case studies in Hyderabad:

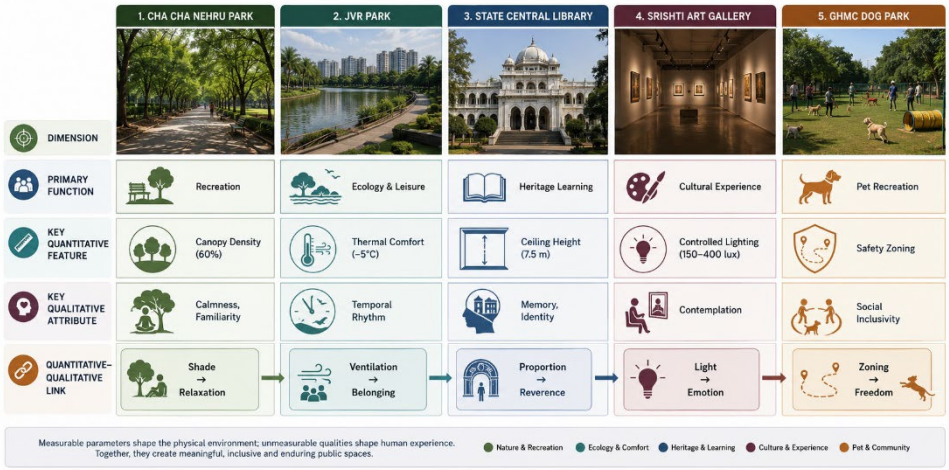


Figure 10. Comparative Analysis of Quantitative and Qualitative Dimensions Across Urban Public Spaces in Hyderabad.

Across all cases, **measurable comfort conditions consistently aligned with positive qualitative experiences**. Spaces with optimized light, temperature, and spatial proportions also exhibited higher emotional engagement and sense of belonging. Conversely, areas lacking environmental moderation—such as unshaded edges of parks—showed diminished user activity and comfort. This confirms the interdependence articulated by,[31] the tangible structure of architecture underpins its intangible meaning.

Emergent Themes

Three overarching themes emerge from the analysis:

1. **Embodied Comfort:** Users' sensory and emotional responses stem from physical metrics like light and temperature—showing that embodied experience is rooted in measurable design parameters.
2. **Memory and Continuity:** Cultural and personal memories embed spaces with meaning; long-term familiarity transforms neutral physical settings into places of attachment.
3. **Social and Environmental Integration:** Public spaces fostering inclusivity and ecological balance simultaneously enhance emotional well-being and environmental performance

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FROM REPRESENTATION TO MEDIATION: TEACHING ARCHITECTURE THROUGH ITS MEDIUMS

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INTRODUCTION

Architecture has always been produced through media. Drawings and models have long served not only as tools of communication but also as active media in which architectural ideas are formed, tested, and transformed. Representational practices shape how we imagine space, the conception of material relationships, and the framing of architectural ideas.[1] Design has never been limited to working directly on buildings; it has always involved working through media. As Marshall McLuhan famously argued, media function as extensions of human perception, actively shaping not only how information is transmitted, but also how thought itself is organized.[2]

Architecture as a Mediated Practice

In contemporary architectural education, the density and diversity of available tools have intensified this condition. Students move fluidly among drawing, digital modeling, image-based workflows, physical prototyping, and computational processes, often within a single project. These shifts are not merely matters of efficiency or technical capacity; they fundamentally alter how architectural ideas are generated and how relationships between space, form, and material are understood. The speed, reversibility, and simultaneity of contemporary tools introduce new forms of translation, feedback, and reinterpretation that were less pronounced in earlier pedagogical contexts.

At the same time, architectural education has tended to treat media primarily as instruments in the service of representation or production. Tools are often framed as means to an end: to communicate a design more clearly, to fabricate a component more precisely, or to visualize a proposal more convincingly. While these functions are undeniably important, they risk obscuring a more fundamental condition: that media actively participate in the formation of architectural thought itself.[3] The selection of a medium, the conventions embedded within it, and the translations required to move between formats all exert influence over what can be imagined, emphasized, or overlooked.

Making mediation explicit, treating media not as neutral channels but as active and formative agents, offers a productive framework for contemporary architectural pedagogy. Rather than asking students to simply select appropriate tools for predefined outcomes, the pedagogical approach discussed here foregrounds the act of translation itself as a site of architectural inquiry. Moving between drawing and model, 2D and 3D formats, and digital and physical processes becomes a form of design work in its own right. In this context, shifts in medium are not simply changes in representation; they are moments in which architectural ideas are reconstituted, reinterpreted, and occasionally destabilized.

The core curricular seminar sequence, *Architectural Mediums,* was developed in response to these conditions. The courses are structured around the premise that architectural thinking is shaped through repeated acts of mediation and translation. Students are asked to work across multiple formats and to reflect critically on how each medium frames spatial, material, and relational possibilities. Rather than emphasizing mastery of any single tool, the series of courses emphasizes the consequences of moving between tools: what is gained, what is lost, and what is transformed in the process. Through this structure, mediation is repositioned from a background condition of architectural work to a central pedagogical objective.

This emphasis aligns with broader understandings from media theory, which assert that technologies and representational systems shape not only how information is transmitted, but how perception and thought are structured. Marshall McLuhan's assertion that media function as extensions of human perception[4] provides a useful point of departure: tools and media are active agents in shaping how architectural relationships are imagined and understood. Robin Evans argues the mediating role of drawing by highlighting how representation is not a neutral mirror to reality, its power lies in its "distinctness from and unlikeness to" the physical condition it represents.[5] By framing architectural education as a mediated practice, pedagogy is situated within contemporary design culture while resisting a purely instrumental view of technology. The goal is not to catalogue tools, but to examine how acts of translation across media can be leveraged as a pedagogical method, positioning mediation as a condition to be actively engaged rather than a technical problem to be negotiated.

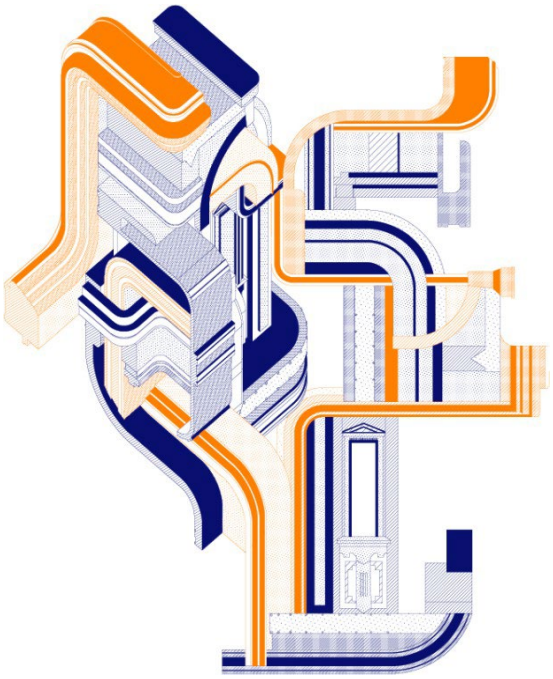


Figure 1. Mediums One: Architectural Threshold, Analytique Drawing

Mediums One: Object and Threshold

The first course in the sequence, Mediums One, introduces students to architecture at an object scale, emphasizing thresholds as sites of formal and experiential inquiry. Thresholds, doors, passageways, or liminal spaces serve as opportunities to explore architectural intention at the scale of encounter, rather than the building as a whole. Through the lens of mediation, students investigate how representational choices, line, shape, ornamentation, material, texture, and perspective frame spatial perception.[6]

Students begin by documenting existing thresholds, analyzing their geometric and material qualities, and exploring their relational context. These studies combine observational drawing, photography, and digital modeling, encouraging students to engage with both architectural conventions and everyday objects. The course emphasizes hybridization, wherein students combine formal qualities from architectural thresholds with qualities from non-architectural objects. This process foregrounds experimentation, encouraging students to speculate about architectural relationships while maintaining analytical rigor.

Through exercises that blend drawing, model-making, and digital reconstruction, students develop a critical awareness of how media shape perception. Each representational act, whether orthographic drawing, photography, or modeling in 3D, requires decisions about framing, scale, and hierarchy. By repeatedly negotiating these choices, students learn that architectural thinking is inseparable from the media through which it is expressed. The course establishes a foundation for later work, emphasizing conceptual clarity, material sensibility, and the creative potential of mediated thresholds.



Figure 2. Mediums One: Architectural Threshold, Drawing Object

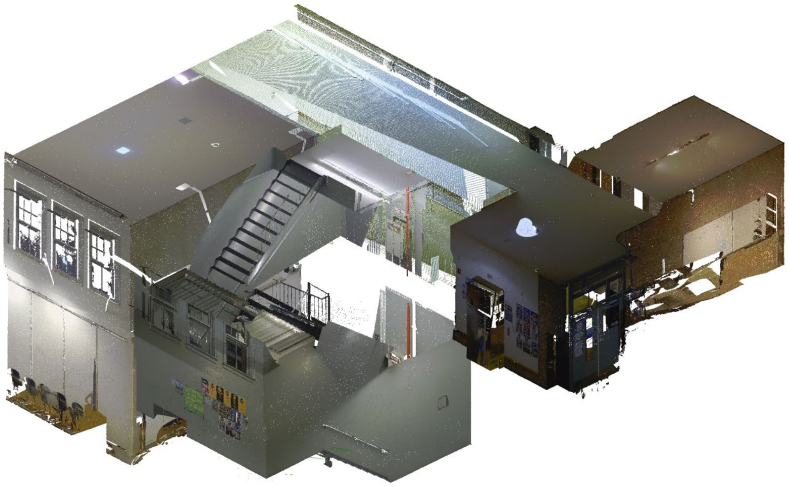


Figure 3. Mediums Two: Building fragment, 3D Scan

Mediums Two: Interiority and Hybridization

Mediums Two shifts focus from object-scale interventions to interior spatial conditions, combining representational rigor with hybridized design exploration. Students begin with fragments of existing spaces derived from a 3D scan of a building, analyzed for poché, circulation, and material relationships. These spatial "chunks" provide the raw data for speculative interventions.

Students work two-dimensionally to hybridize these fragments, integrating precedent study, formal exploration, and spatial manipulation. This process encourages the reinterpretation of existing elements, fostering a dialogue between observation, imagination, and design intent. 3D visualization tools, including V-Ray and material-mapping workflows, allow students to test atmospheres, lighting conditions, and textural qualities, reinforcing the interdependence of spatial design and representation. Workflows moving from 3D to 2D, and vice versa, remain central, supporting precise documentation, hierarchical organization, and coordination of complex interior systems. Rather than emphasizing a single software platform, the course frames a conceptual workflow: a method to structure, visualize, and manipulate spatial information while maintaining fidelity to real-world constraints. Students iterate between 2D plans, 3D models, and rendered perspectives, reflecting on how digital and physical processes inform design deci sions.

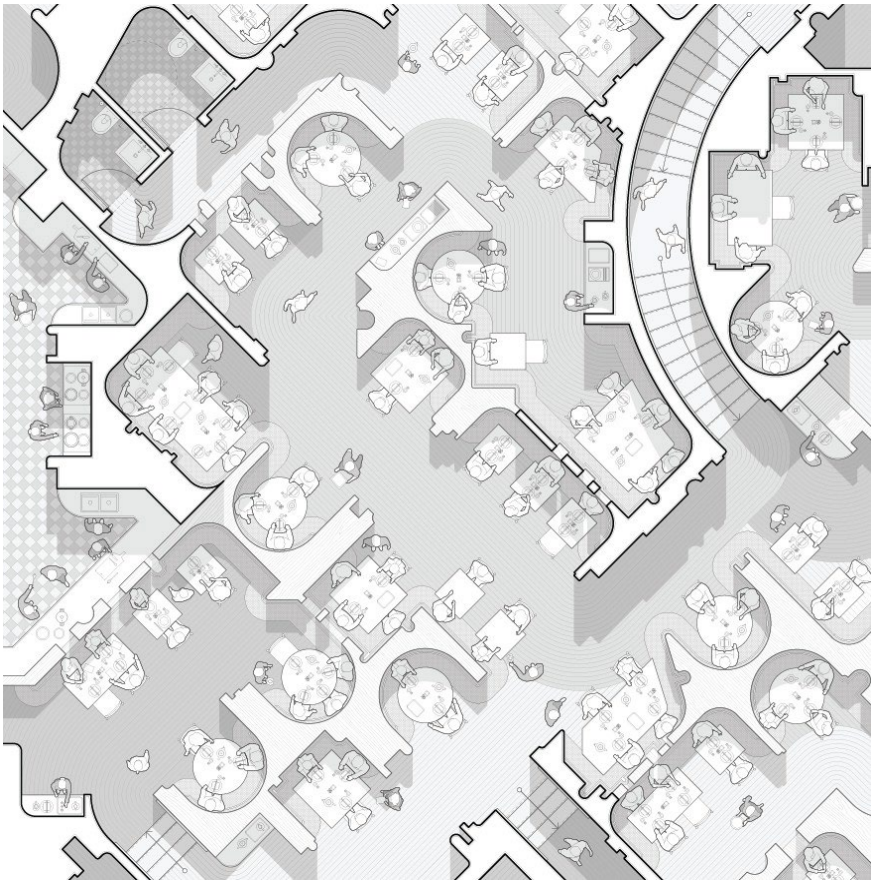


Figure 4. Mediums Two:Design development of a building fragment through 2D drawing

Assignments emphasize cumulative skills: initial analysis of existing spatial conditions; hybridization of fragments through precedent-based interventions; plan development; and iterative rendering and modeling. These tasks cultivate sensitivity to architectural thinking while reinforcing an integrated workflow that balances technical precision with speculative creativity. Mediums Two thus bridges the concrete object-focused explorations of Mediums One with the complex, media-driven arguments of Mediums Three.

Mediums Three: Specialized Tracks in Visualization, Communication, and Fabrication

Mediums Three allows students to specialize in one of three tracks, Visualization, Communication, or Fabrication, deepening their engagement with media as both representational and generative. Students choose a single track, developing expertise in its methods while engaging with broader questions of architectural mediation and translation.

The Visualization track emphasizes constructed perspectives, atmospheric rendering, and compositional control. Students develop a visual argument beginning with photographic observation and evolving into a speculative representation of a site, such as New York City. Techniques include photography, physical modeling, generative AI, Rhino material mapping, rendering, and post-processing in Photoshop. Students synthesize historical and contemporary precedents, analyzing compositional strategies, materiality, and narrative potential. The final work combines digital and physical artifacts, producing scenes that operate simultaneously as images and spatial experiences.

The Communication track investigates architectural analysis and computational processes through drawing and data-driven methods. Students select a building and explore it through multiple analytical lenses, including material systems, waste systems, circulation, and occupancy. Emphasis is placed on

creating a hybrid representational language, where drawings synthesize research, observation, and analysis into a coherent argument. Assignments progress from individual analytical drawings to collective compositions, culminating in a single, layered hybrid drawing that communicates nuanced spatial understanding.

The Fabrication track focuses on the intersection of material, method, and assembly. Students research architectural and non-architectural precedents to develop a novel detail assembly and prototype. Iterative making and material exploration inform a proposal that integrates research with advanced fabrication techniques. Students consider material properties, joint systems, and constructability while pushing formal and compositional possibilities. Final deliverables include both physical prototypes and detailed design documentation that communicates the assembly's spatial and tectonic logic.

Across all tracks, Mediums Three emphasizes design research, conceptual rigor, and media fluency. Students are tasked with making design choices that consider both perceptual and practical implications, developing expertise in their chosen track while engaging broader questions of representation, translation, and mediation.

PEDAGOGICAL PRINCIPLES: MEDIATION, TRANSLATION, AND REFLECTION

Across the sequence, several pedagogical principles guide student engagement. Mediation treats every medium, drawing, modeling, computational modeling, generative artificial intelligence, rendering, or fabrication, as an active participant in architectural thinking. Students are encouraged to recognize how media influence perception, material understanding, and spatial reasoning.

Translation emphasizes the movement of ideas between formats. Whether transferring a concept from 2D drawing to 3D model, from digital development to physical prototype, or from analytical research to speculative design, students confront the gains and losses inherent in translation. This process encourages reflective decision-making and critical assessment of medium-specific effects.

Hybridization, particularly emphasized in Mediums One and Two, encourages students to combine disparate elements, architectural and non-architectural, observed and speculative, to generate novel formal and spatial relationships. By assembling these hybrids, students explore unforeseen design possibilities and learn to negotiate material, formal, and spatial constraints.

Critical reflection is embedded throughout the sequence. Students regularly evaluate technical decisions alongside conceptual implications, integrating feedback, self-assessment, and precedent analysis to reinforce media-conscious design thinking.

Together, these principles cultivate agency, adaptability, and media literacy, equipping students with transferable skills applicable across diverse design contexts and professional workflows.

CONCLUSION

The Architectural Mediums sequence positions media not as ancillary tools but as central agents in the formation, exploration, and communication of architectural ideas. Across the sequence, students move from object-scale interventions in Mediums One, through the hybridization of spatial fragments and interiorities in Mediums Two, to complex, media-driven arguments in Mediums 3. This progression advances a critical understanding of architecture as an ongoing process shaped through the interdependency of media, materiality, spatial logic, assembly systems, and the techniques through which these conditions are enacted.

By foregrounding mediation, the sequence encourages students to recognize the inseparability of form, medium, and concept. Technical proficiency, whether in drawing, digital modeling, computational processes, artificial intelligence, rendering, or fabrication, is integrated with reflective practice,

enabling students to evaluate and adapt design decisions in real time. Hybridization, iteration, and translation emerge as recurring strategies, not as prescriptive rules, but as methods to explore alternative relationships, synthesize disparate ideas, and generate unforeseen architectural possibilities. The pedagogical value of this approach extends beyond the immediate sequence. Students develop transferable skills in critical observation, media-conscious thinking, and conceptual communication, which are essential for navigating the increasingly complex and technologically mediated landscape of contemporary architecture. They learn that the choices embedded in media, whether it be line weight, 2d or 3d formats, analog or digital, or material selection, have consequences for perception, understanding, and design outcomes. By foregrounding these choices, the sequence fosters agency: students are not passive operators of tools, but active participants in shaping architectural discourse.

Furthermore, the sequence demonstrates the importance of reflective design processes. Students learn to interrogate their own work, trace conceptual and material decisions across media, and assess the implications of these choices for spatial experience. The curriculum cultivates a balance between experimentation and rigor, allowing for creative risk-taking while grounding design decisions in material, structural, and spatial logic. This dual focus on exploration and critical evaluation ensures that architectural representation remains both expressive and disciplined, speculative and precise.

Looking forward, the implications of this pedagogy suggest new possibilities for architectural education and practice. By treating media as generative rather than merely instrumental, educators can cultivate designers fluent not only in tools and techniques, but in the conceptual, perceptual, and material consequences of representation. Sanford Kwinter's reflections on architectural time and event underscore that design possibilities are shaped not just by final forms, but by the conditions, media, and processes through which ideas are explored, tested, and enacted.[7] Students emerge equipped to navigate complex design problems, experiment thoughtfully, and produce work that is both media-savvy and conceptually robust. In an era of rapid technological change, such fluency provides a sustainable foundation for professional growth, creative innovation, and thoughtful engagement with the evolving building environment.

Ultimately, the Architectural Mediums sequence models an approach in which design, media, and pedagogy are mutually constitutive. It underscores that architectural thinking is shaped not only by ideas, but by the tools through which those ideas are generated, tested, and communicated. By making mediation and explicit concern, the sequence fosters a richer, more reflexive, and adaptable form of architectural education, one in which students are empowered to explore, question, and redefine the possibilities of design itself.

NOTES:

[1] Robin Evans, “Translations from Drawing to Building,” in *Translations from Drawing to Building and Other Essays* (MIT Press, 1997), 186.
[2] Marshall McLuhan, *Understanding Media: The Extensions of Man* (McGraw-Hill Book Company, 1964, n.d.), 4.
[3] Dalibor Vesely, *Architecture in the Age of Divided Representation: The Question of Creativity in the Shadow of Production* (MIT Press, 2004).
[4] McLuhan, *Understanding Media: The Extensions of Man*.
[5] Evans, “Translations from Drawing to Building,” 154.
[6] Evans, *Translations from Drawing to Building*
[7] Sanford Kwinter, *Architectures of Time: Towards a Theory of the Event in Modernist Culture* (MIT Press, 2002), 14.

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TRANSFORMING ARCHITECTURE DESIGN STUDIO: THE IMPACT OF AUGMENTED REALITY TECHNOLOGIES ON EXPERIENTIAL LEARNING

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INTRODUCTION

The emergence of immersive Augmented Reality (AR) environments marks a transformative moment in architectural practice, enabling the simulation of architectural ambiances through real-time, multi-sensory spatial experiences. By integrating advanced digital technologies, AR extends beyond traditional visualization methods to foster enriched sensory engagement, deeper user experience, and critical reflection. Most recent studies indicate that users' interactions with immersive AR, where real and virtual objects coexist and interact, significantly influence their learning outcomes and overall experience.

The presentation proposes an analytical framework to structure and enhance the learning potentials of AR within architecture design studios, aiming to foster more vibrant, inclusive, and ethically grounded educational activities. Focusing on innovative learning strategies developed for the design studio at The University of Oslo, this research investigates the digital tools and techniques that facilitate new modes of exploration, interaction, and interpretation of architectural ambiances. By emphasizing real-time image representation integrated with physical prototypes, the University of Oslo case study exemplifies how AR empowers architects to communicate, prototype, and iterate ambiance-oriented designs in previously unimaginable ways. The primary goal of the presentation is to demonstrate how AR-based ambiance simulation positions digital technologies as essential instruments for creating, evaluating, and ethically stewarding the sensory qualities of architectural space. Through this presentation, I will highlight AR's relevance not only for simulating architectural ambiance but also for ethically informing future pedagogies in architecture design education.

Hybrid Realities: AR's Shift in Architectural Ambiance

The advent of immersive Augmented Reality (AR) environments signals a pivotal shift in architectural education, reshaping the way architectural ambiances are conceived, experienced, and taught within design studios. Architecture as a discipline has always depended on technologies of representation—from hand-drawn plans to digital renderings. The advent of computational media and AR signifies a radical evolution wherein architectural ideas are not merely visualized but experienced. AR overlays digital content onto physical environments, creating hybrid spaces where users participate in real-time “negotiations” between reality and augmentation. In learning environments, AR facilitates real-time, multi-sensory spatial simulations that integrate virtual objects within physical

contexts, enabling students to engage in a hybrid reality where real and digital elements co-exist and interact dynamically. This transformative potential extends beyond mere representation, positioning AR as a conduit for enriched sensory engagement, deeper critical reflection, and enhanced experiential learning. Building on contemporary understandings of architectural ambiance—the atmospheric and sensory qualities that shape spatial experience—this paper examines how AR can be integrated into architectural pedagogy to foster vibrant, inclusive, and ethically minded design practices.

DEFINITION OF AMBIANCE AND THE PROMISE OF AR FOR AMBIANCE-ORIENTED DESIGN

Ambiance, as theorized by scholars such as Jean-Paul Thibaud[1] and Juhani Pallasmaa,[2] refers to the atmospheric, affective, and sensory qualities of a space—qualities that are often difficult to capture through conventional visual representation alone. AR offers a paradigm shift by enabling designers and users to experience architectural ambiances in situ, before construction or after the architectural building or site have been demolished or ruined. Through real-time overlays of visual, auditory, and potentially other sensory data, AR can simulate the dynamic interplay of light, sound, texture, and movement that constitutes ambiance.[3] This opens up new possibilities for participatory design, user testing, and iterative refinement of spatial experiences.

THEORETICAL BACKGROUND: SENSORY ENGAGEMENT AND EXPERIENTIAL LEARNING IN ARCHITECTURE

For example, by overlaying dynamic digital content—including visuals, sounds, and potentially haptic feedback—onto real-world environments, AR fosters a holistic sensory engagement that integrates multiple perceptual channels simultaneously. This multisensory integration aligns strongly with contemporary calls in architecture and education research for more immersive, embodied learning methods that enhance spatial cognition and experiential knowledge.[4]

Within architectural education, especially in design studios, such embodied and participatory learning approaches are increasingly recognized as vital. Experiential learning theories emphasize active engagement, reflection, and ethical awareness as foundational to cultivating designers' capacities to respond holistically to spatial and social complexities.[5] AR technologies situate learners within such evolving, interactive spatial scenarios, enabling sensorimotor engagement that supports kinesthetic learning and promotes inclusivity by accommodating diverse modalities of experience and expression. Current empirical studies reveal that AR-mediated interactions can significantly influence spatial perception and educational outcomes by enhancing embodied cognition, enabling iterative design explorations, and fostering critical reflection.[6] However, despite these promising developments, research gaps persist in understanding how AR fundamentally transforms the architecture design studio as a pedagogical space—particularly regarding the equitable integration of sensory and ethical dimensions, the development of tailored learning frameworks, and the longitudinal impacts on students' design cognition and collaborative practices. There is a need to move beyond technological novelty towards systemic educational integration that holistically addresses architectural ambiance as a core learning objective.

PROBLEM STATEMENT

This said, the research investigates the transformative effects of immersive Augmented Reality technologies on the architecture design studio as a site of experiential learning. While AR enables real-time, multi-sensory simulations that enrich embodied cognition and sensory engagement, there is a lack of comprehensive pedagogical frameworks and empirical evidence detailing how these

technologies can be systematically integrated to enhance learning outcomes. The problem centers on understanding how AR reshapes the design studio's experiential landscape—promoting inclusion, ethical reflection, and iterative design practice—and on articulating strategies to embed AR as an essential educational tool. My case study responds to this challenge by proposing and evaluating an analytical framework, exemplified through innovative learning strategies developed at the University of Oslo design studio, to harness AR's capacity for transforming architectural pedagogy.

CASE STUDY: AUGMENTED DESIGN OF IMMERSIVE EXPERIENCES OF CULTURAL HERITAGE

The Munch Museum, a building that holds the legacy of Edward Munch, the most important artist in Norway's history, and a place imagined to discover not only Munch's artworks, but also Oslo and its history. The museum's layered history and architectural richness, and cultural significance of Munch's legacy, present unique challenges and opportunities for the first stage of experiential learning in the architecture design studio. The design problem was future Munch Museum, not only as a facility to safeguard and exhibit a fundamental heritage in the history of Norwegian culture. It also constitutes a unique opportunity to develop a contemporary museum concept, nourished by a highly significant urban role and historical responsibility as a cohesive element of the community, not only of Oslo but also of the entire nation.[7] In the first stage of the process, students were working as a group to create a huge memory map of the museum historic site. This stage is imagined as restaging the past and was premised on the belief that the city and its collective dreams have built the new Munch Museum (it is an expression of the collective engagements of the Norwegian society to the environment echoing its present challenges and the desire for innovation that steps forward into a better future). Immersive AR has been deployed as a tool to facilitate the experience of The Munch Museum's architectural ambiance, blending digital constructions with the physical elements of the site. The project aimed to not only document and visualize The Munch Museum's building but to evoke the its cultural atmospheres—its spatial rhythms, and the orchestration of spatial organization and a walk through the artworks that used to animate the site.

Regarding the methodology, several steps were undertaken: 1) Site scanning and 3D modeling: The project began with high-resolution photogrammetry and LiDAR scanning of the museum's site, capturing the geometry and surface details of the structures. 2) Historical research and digital construction: Archival photographs, oral histories, and documents informed the digital construction of a walk, from interior spaces to building facades. 3) Ambiance simulation: Using AR, digital overlays were superimposed onto the physical site, enabling viewers to experience a new building, historical visual and soundscapes, and simulated material conditions in real time (light and sound, as if the viewer was there). 4) User interaction: Viewers, equipped with AR headsets or mobile devices, could navigate the site, triggering different layers of digital content through their movement and orientation (Munch paintings). For example, approaching a building might activate an audio narrative or reveal a virtual interior.

This participatory and embodied model made moves away from static visualization to embrace AR as a dynamic medium for co-creating architectural ambiance, thereby fostering more ethical, inclusive, and responsive design learning processes.

The Munch AR project demonstrated several key potentials of immersive AR for simulating architectural ambiance. By integrating visual, auditory, and kinesthetic cues, the AR experience enabled a richer, more embodied encounter with cultural heritage than traditional media could provide. The use of real-time overlays allowed for dynamic adaptation to changing environmental conditions—lighting, weather, user perspective—enhancing the realism and immediacy of the

experience. The interactive nature of AR encouraged users to explore, discover, and interpret the site actively, fostering a sense of personal connection and agency. The project also raised important questions about authenticity, authorship, and the politics of heritage representation. Whose narratives are privileged in the digital reconstruction? How can AR be used to honor, rather than appropriate, cultural memory?

The Munch Museum case study exemplified such analytical framework for AR-based ambiance simulation. Accurate site scanning underpinned the veracity of digital overlays. Visual stories (based on Munch's paintings) and soundscapes were contextually triggered, responding to user movement and environmental cues. Kinesthetic engagement was central, as users' physical navigation shaped the unfolding of digital content. User feedback informed ongoing refinement, ensuring that the simulated ambiance resonated with both contextual evidence and contemporary experience.

AUGMENTED DESIGN ENHANCES IMMERSIVE HERITAGE EXPERIENCES

AR enabled visitors to "walk through the memories" of The Munch Museum. Namely, by overlaying digital constructions, historical narratives, and interactive elements onto the real site, AR weaved together stories, paintings, and sensory cues. This approach, which Dima and Maples refer to as *affectual dramaturgy,*[8] fuses viewer's interaction with the site's history, increasing emotional engagement and contextual understanding. As a result, a viewer can develop a more personal and complex relationship with The Munch Museum, experiencing its history and legacy as a living, unfolding journey rather than static information. Affectual dramaturgy leverages immersive storytelling, combining historical objects, archival documents, and dramatized narratives to create an imaginative, "lived" environment for viewers. Thus, AR technology can trigger digital content—such as sounds, images, or interactive scenes—based on a viewer's movement and choices, making each experience unique and personal. This interactivity fosters a sense of agency, encouraging viewers to become "archive makers" who help shape the unfolding story of Munch Museum.

The immersive potential of AR lies in its ability to engage the user's body as an instrument of perception. Building on the philosophical insights of Bergson, Massumi, and Hanson, the kinesthetic approach recognizes that spatial experience is fundamentally embodied. AR environments, by tracking and responding to user movement, allow for the simulation of a body's kinesthetic relationship with space—walking through a space, perceiving shifts in light and sound, interacting with virtual objects (paintings)—that are essential to the experience of ambiance. Recent educational experiments, such as those at ETH Zurich, demonstrate that users in mixed reality environments describe space less in terms of static features and more in terms of movement and interaction. As Beatrix Emo observes in her paper, "when describing the project in Mixed Reality students referred more to the movement through the building than about space.[9] This suggests that the experience and presentation of space in Mixed Reality appears to be based more on the movement in space, than by a fixed observer."[10]

Recent studies support the argument by claiming that users interacting with 3D real-size AR materials exhibit enhanced spatial perception, as evidenced by longer and more varied gaze movements and richer spatial descriptions related to depth, height, and width. Kim, Xiang, and Ryu's findings highlight how AR facilitates an embodied spatial experience where the user's movement and visual engagement dynamically shape their perception of space, thus emphasizing the interplay between physical space, digital imagery, and bodily interaction.[11] These studies collectively support the assertion that AR-based simulations open new avenues for spatial experience by actively engaging the user's body and senses in a dynamic relationship with augmented images and real space. By extending the kinesthetic approach into the digital realm, AR enables the development of analytical

frameworks where real-time image representation is not passive but actively shaped by the user's presence and actions. This participatory model of ambiance simulation aligns with contemporary shifts toward user-centered and experiential design. The case study demonstrates clear enhancements in student engagement and learning outcomes, highlighting AR's capacity to promote a deeper sensory and ethical understanding of architectural space.

Technological infrastructure: hardware, software, and creative toolsets

The realization of AR-based ambiance simulation depends on an evolving ecosystem of hardware and software. Modern AR devices—ranging from smartphones and tablets to head-mounted displays—are equipped with sensors for motion tracking, depth perception, and environmental mapping. These capabilities support the seamless integration of digital content with physical space, enabling real-time, context-sensitive augmentation. Software platforms such as Unity[12] and Unreal Engine provide robust toolsets for creating interactive, multi-sensory experiences. These platforms facilitate the design and deployment of virtual elements, from photorealistic lighting and materials to spatial audio and haptic feedback. The convergence of AR with virtual production techniques from film and gaming further expands the creative possibilities, allowing for the simulation of complex ambiance scenarios. The technical infrastructure thus supports not only the visualization of heritage architecture but their simulation as lived, multi-sensory experiences. This shift from representation to simulation is foundational to the development of ambiance-oriented design methodologies.

Ethical and inclusive practice

A key aim of AR-based ambiance simulation is to ethically steward sensory qualities of space. By encouraging students to critically reflect on representation and experience, design studios can address questions of authenticity, inclusivity, and cultural memory. AR empowers students to approach ambiance simulation as both creative and responsible practice, responsive to diverse user needs and ethical considerations.

CONCLUSION

As architecture continues to integrate computational media, AR stands at the forefront of a new era in which ambiance is not merely represented but actively experienced, negotiated, and co-created. The challenge and promise of this shift lie in harnessing AR's potential to foster more vibrant, inclusive, and ethically grounded architectural environments. Positioned as essential educational instruments, AR technologies enable a synthesis of creativity, evaluation, and ethical stewardship in architectural learning. By simulating ambiance within real spatial contexts, AR facilitates exploratory and participatory pedagogy that embraces multi-sensory experience, inclusivity, and social responsibility. This paradigm invites educators to rethink design studio formats, encouraging experiential, reflective, and ethically informed practices supported by immersive digital tools.

NOTES

[1] Read more in: Jean-Paul Thibaud, "The backstage of urban ambiances: When atmospheres pervade everyday experience," *Emotion, Space and Society,* Vol. 15 (2015): 39-46.
[2] Read more in: Juhani Pallasmaa, *The Eyes of the Skin: Architecture and the Senses* (Chichester: Wiley, 2005).
[3] This study discusses how AR systems integrate ambient visual and auditory elements in real time to enhance immersion and simulate complex environments, demonstrating how multi-sensory augmentation contributes to the perception of ambiance in mixed reality settings. Read more in: Meng-Tzu Cheng, Hsiao-Ching She & Leonard A. Annetta, "Game immersion experience: its hierarchical structure and impact on game-based science learning," *Journal of Computer Assisted Learning* 31(3), (2015): 232-253.
[4] Tomás Dorta and Gokce Kinayoglu, "Towards a New Representational Ecosystem for the Design Studio," in *Proceedings of the 19th International Conference on Computer Aided Architectural Design Research in Asia CAADRIA 2014*, ed. Watanabe S. Gu, H. Erhan, M. Hank Haeusler, W. Huang, R. Sosa (Hong Kong: The Association for Computer-Aided Architectural Design Research in Asia CAADRIA, 2014), 699–708.
[5] Read more in: David Kolb, "Experiential Learning: Experience as the Source of Learning and Development," *Journal of Business Ethics*, Vol. 1 (NJ: Prentice Hall, 1984). ISBN: 0132952610
[6] Read more in: Hongbo Zhang *et al.* "IEDS: Exploring an Intelli-Embodied Design Space Combining Designer, AR, and GAI to Support Industrial Conceptual Design," in *CHI '25: Proceedings of the 2025 CHI Conference on Human Factors in Computing Systems*, Article No.: 33, ed. Naomi Yamashita *et al*., 1 – 25 (Publication History, 2025). https://doi.org/10.1145/3706598.3713528
[7] "ArchDaily," New Munch Museum / Estudio Herreros, accessed December 5, 2025. https://www.archdaily.com/971237/new-munch-museum-estudio-herreros
[8] Dima Mariza and Holly Maples, "Affectual Dramaturgy for Augmented Reality Immersive Heritage Performance," *Body, Space & Technology* 20 (1), (2021): 25–36. DOI: https://doi. org/10.16995/bst.368
[9] As Beatrix Emo concluded in her paper, "when describing the project in Mixed Reality students referred more to the movement through the building than about space. This suggests that the experience and presentation of space in Mixed Reality appears to be based more on the movement in space, than by a fixed observer." Read more in: Beatrix Emo, Andri Gerber and Christoph Hölscher, "User centered spatial thinking in architectural design with mixed reality," in *Towards a new, configurable architecture*. *Proceedings of the 39th eCAADe Conference* Vol. 2, ed. V. Stojakovic and B. Tepavcevic (Novi Sad: University of Novi Sad, 2021), 115-122.
[10] Emo, et al, *User centered spatial thinking*, 115-122.
[11] Kim Kukhyeon, Hongyu Xiang and Jeeheon Ryu. "The Exploratory Analysis of Spatial Perception in Augmented Reality Application with Scan Path and a Task Achievement." In *ICoME 2022* (International Conference for Media in Education), edited by Vera L. Glushenko, 123-125. TCC Hawaii, 2022. https://2022.icome.education/wp-content/uploads/2022/07/KIM22060-Kukhyeon-Kim.pdf
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CUTTING OUT CARTOGRAPHIES: FROM MAP DRAWING TO CARTOGRAPHIC COLLAGE IN CONTEMPORARY URBAN PEDAGOGY

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INTRODUCTION

This paper examines a pedagogical sequence in undergraduate architectural education that combines territorial map drawing and historical cartographic collage as a method for approaching the complexity of urban form. The context is the second-year urbanism studio at the Barcelona School of Architecture ETSAB-UPC, where students are introduced to urban analysis through two linked exercises: first, the hand drawing of large-scale territorial maps from aerial imagery; secondly, the production of an authored collage using at least four historical maps from open archives. While seemingly simple, this sequence establishes an intellectual movement from descriptive representation to interpretative construction, and from synchronic reading to diachronic urban narration.

This exercise can also be situated within a local genealogy of urban representation. It continues a tradition promoted by the Laboratori d'Urbanisme de Barcelona (LUB-UPC) in the late 1970s and 1980s, which, in Solà-Morales's terms, confronted "the problem of expressing knowledge through the creation of maps". In that tradition, cartographic description was not conceived as neutral recording but as a critical operation: a 'super-realist' intention in which the precise selection and evaluation of elements seek a new interpretation—and, with it, a critical reading—of the territory.[1]

The theoretical starting point is that mapping is never neutral. Cartographic production is shaped by the dynamic interplay between artistic creativity and technological innovation, not by technical progress alone. It likewise describes the longer historical trajectory as a progressive shift from manual artistry towards high digital integration, while emphasizing that hybrid forms continue to preserve expression and interpretation. These claims are directly relevant to pedagogy: if map-making consistently negotiates between technique, aesthetics and epistemology, then teaching map-making is also teaching how knowledge is selected, structured and argued.

This issue is acute in contemporary urbanism education. Students today encounter the city through satellite imagery, GIS layers, interactive platforms and vast digital repositories. These tools are indispensable, yet they can obscure the interpretative labor of mapping by presenting data as complete and immediately legible. The pedagogical model discussed here resists that passivity. Students are asked to draw, select, cut, superimpose and compose. In doing so, they recover a central disciplinary insight: representation is not the end of analysis but one of its principal engines.

The work sequence developed in class produces three core capacities crucial to current architectural training: scalar and territorial synthesis, historical-temporal reasoning through palimpsest thinking,

and critical authorial judgement under conditions of visual-data abundance. The paper first situates the approach in relation to cartographic history and collage discourse, then defines a pedagogically useful distinction between cartography and drawing maps, analyses the two exercises, and discusses broader implications for urban education and research.[2]

FROM EARLY CARTOGRAPHIC METHODS TO COLLAGE THINKING

Within the broad evolution in mapping practices from manuscript and engraved traditions, through photomechanical reproduction, to digital and interactive geospatial systems, development is not linear and not purely technological. Rather, each period reorganizes the relation between precision, reproducibility and expression: modern cartographic culture has not replaced manual practices entirely but has generated hybrid methodologies that combine manual artistry with digital automation. For architectural pedagogy, the implication is clear: the aim is not to choose one medium against another, but to combine them in ways that intensify critical reading.

The academic exercise challenges the opposition between scientific map and creative image. The analysis of photomechanical techniques[3] shows how industrial reproduction changed consistency, dissemination and authorship in map production. In turn, mapping technologies are historically situated systems that structure visibility and action.[4] Additionally, work on maps and modernity adds that twentieth-century cartography intersects with artistic and cultural experimentation, opening representational space for reflexive and non-neutral forms.[5]

More specifically, the reciprocal relation between cartography and collage constitutes a methodological crossing in which collage serves cartographic analysis and cartography itself can be understood as assemblage.[6] This logic can be extended through timeline collaging,[7] combining georeferencing and time-referencing to make temporal change legible in compositional form. In the same direction, fragment-based map evolution analysis and deformation-based cartographic genealogy studies treat maps as transformable fields of parts and traces rather than immutable surfaces.[8]

Within architectural and urban theory, the turn to collage is often traced through Collage City, [9] which framed collage as both metaphor and projective method for negotiating historical continuity, modernist rupture and incremental urban growth. Phenomenological accounts expand this argument beyond technique, describing collage and montage as characteristic modes of modern representation, capable of producing ‘archaeological density’ and non-linear narratives through the juxtaposition of fragments from irreconcilable origins. From this perspective, even architecture—despite its apparent permanence—operates as an ‘ever-changing collage’ of activities, furnishing and objects, in which tactility and time are experienced through layered material presences.[10]

Comparative assessment between manual and digital collage remains limited, particularly regarding interpretative depth, aesthetic efficacy and reception. It is also to be noted the persistent difficulty in translating tactile, embodied and exploratory qualities of manual practice into digital workflows. This gap provides strong support for hybrid studio pedagogy: if neither manual nor digital methods are sufficient alone, the educational task is to construct structured combinations that preserve rigor while enabling invention.[11]

CARTOGRAPHY AND DRAWING MAPS: A PEDAGOGICAL DISTINCTION

A central conceptual move in the course Urbanistica 2 at ETSAB-UPC[12] is distinguishing cartography from drawing maps. Cartography usually refers to codified representation with established conventions of projection, symbolization, scale and accuracy. Drawing maps, by contrast, is approached as exploratory and projective practice in which inclusion, emphasis, omission and relation are argumentative operations.[13] The distinction is methodological rather than absolute, since both

modes often coexist in a single artefact. Its value lies in clarifying that a map may be technically correct yet conceptually weak, or technically selective yet analytically powerful.[14]

This distinction is aligned with the emphasis on the continuing integration of scientific rigor and artistic creativity. Historical and contemporary map-making cannot be reduced to instrumentality; visual rhetoric, composition and symbolic choices shape interpretation at every stage. In educational terms, students therefore need both disciplinary control and interpretative agency. Without control, representation drifts into arbitrariness. Without agency, representation becomes inert. The two-exercise sequence is explicitly designed to hold these two conditions together.[15]

In this framework, drawing becomes a form of territorial hermeneutics. The descriptive phase is expected to be deliberately 'obsessive', not as an end in itself but to intensify the synthetic capacity of conceptual work. What the LUB tradition called descriptive calligraphy is therefore understood as more than literal depiction: it is a literary mode of representation in which narration and description operate at the scale of territory, enabling an 'architecture of ideas' rather than mimetic likeness. The associated epistemic maxim is that to know is to propose: drawing is a way of knowing the physical form of the territory in order to act upon it. Accordingly, there is no single universal code shared by all drawings; what matters is the argumentative clarity of the chosen graphic criteria—often articulated through concise and contrasted marks, selective detail, and explicit hierarchies.[16]

PEDAGOGICAL SEQUENCE: TWO EXERCISES, ONE EPISTEMIC ARC

The first exercise requires students to draw an urban-territorial fragment from aerial imagery at scales generally ranging from 1:10,000 to 1:100,000 on large-format sheets (Figure 1). Physical site visits are deliberately deferred. The immediate objective is to train structural reading: topography, hydrography, settlement edges, infrastructural lines and transitions between built and unbuilt systems. This produces selective precision, because drawing cannot be reduced to tracing and demands judgement about what constitutes structure and what constitutes noise. It also produces hierarchical clarity, as line weight, density and omission become analytical devices. Equally important, it strengthens scale literacy by forcing students to recognize which relations persist and which disappear across scalar shifts. Finally, it cultivates epistemic awareness by confronting students with the limits of mediated vision.[17]

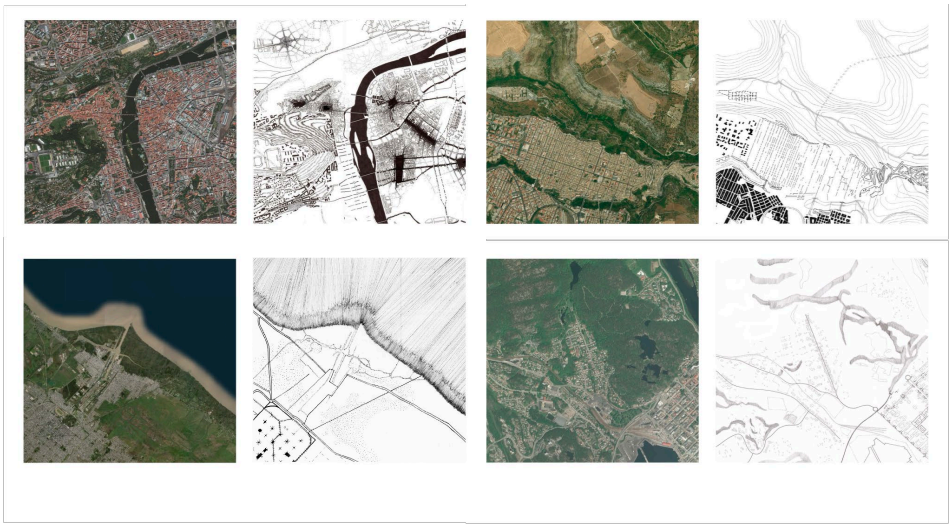


Figure 1. Fragments of hand-drawn interpretative maps produced by Urbanística 2 students at ETSAB–UPC. From left to right and top to bottom: Prague, by Joel Prat and Marc Prim (2020); Ragusa, by Neus Cardona (2020); La Plata, by Anna Simó and Maria Varón (2022); and Kristiansand, by Laura Barrera (2022).

The second exercise introduces temporal depth. Students collect at least four historical maps from open repositories and compose a personal cartographic collage. The aim is not neutral chronology but an argued reading of urban transformation through selection, juxtaposition, displacement and recomposition. The city is treated as palimpsest, where persistence, erasure and mutation coexist. Students must compare documents produced under different technical conventions and institutional intentions, evaluate their compatibility, and decide what to foreground. In this phase, collage becomes a method of reasoning, because every compositional choice implies a historical claim (Figure 2).[18]

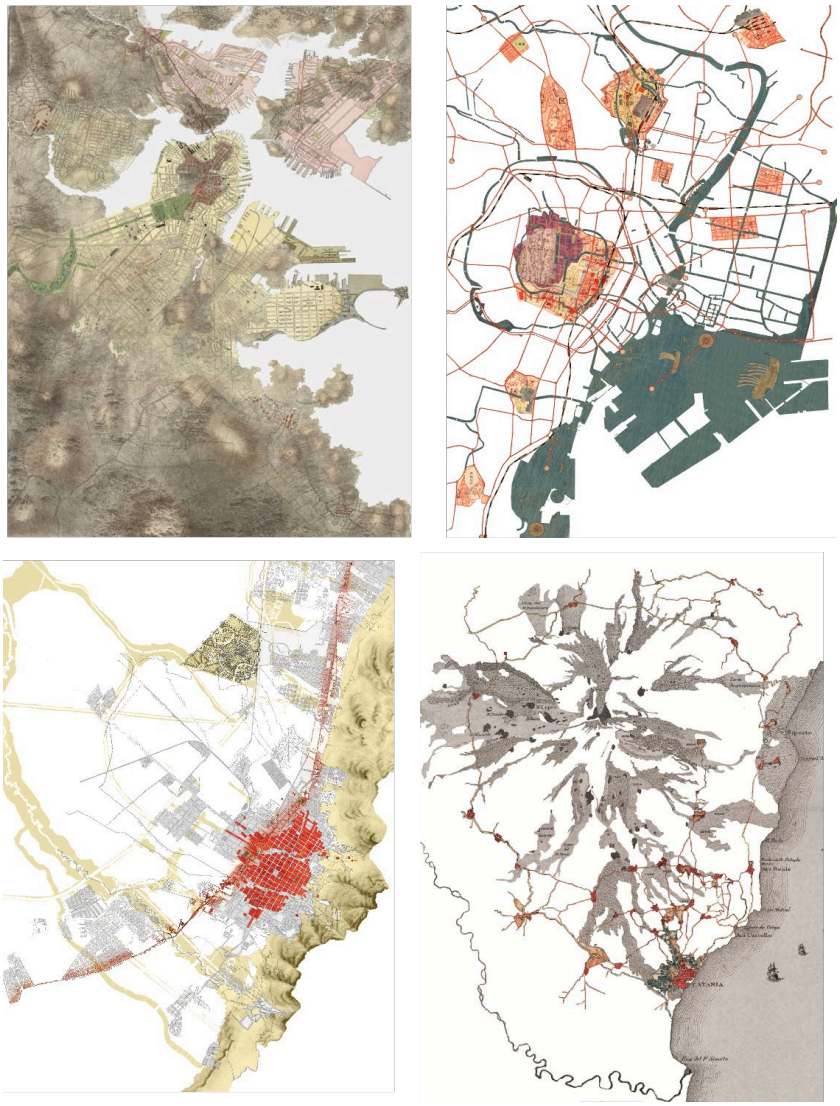


Figure 2. Collage maps produced by Urbanística 2 students at ETSAB–UPC. From left to right and top to bottom: Boston, by Lena Carles and Berta Claramunt (2025); Tokio, by Gina Ambel and Andrea Buisán (2025); Bogotá, by Jan Santandreu and Lluc Sistach (2025); and Catània, by Arianne Miller and Judith Notario (2024)

The movement from exercise one to exercise two is therefore a movement from descriptive discipline to interpretative authorship. Students do not abandon rigor when they begin to collage; rather, they apply rigor to temporal construction and source criticism. The sequence as a whole demonstrates that representation can operate as a cumulative epistemic arc rather than as disconnected tasks.[19]

Layering, collage and method

Within the course, layering and collaging are treated as related but distinct operations. Layering superimposes datasets or historical maps to reveal persistence and rupture. Collaging actively recomposes selected fragments to produce an argument. Layering is powerful for evidentiary comparison, yet it can become visually congested or descriptively passive if not guided by a clear question. Collage introduces editorial decision and positionality, but it can become decorative if detached from evidence. The pedagogical objective is to move from accumulation to argument, ensuring that visual composition remains accountable to historical and spatial reasoning.

The conceptual grounding for layering is closely aligned with Corboz's influential metaphor of the territory—and by extension the city—as a palimpsest: a surface repeatedly inscribed, scraped and reinscribed, where accumulation coexists with erasure and lacunae.[20] In this sense, the cartographic plates produced in the studio can be understood as a 'sum of cartographies'—overlayered documents whose registration is not only technical but interpretative, because each layer carries the institutional and cultural assumptions of its moment of production.

This method responds directly to diverse concerns, including heterogeneity of sources, problems of fidelity in digital transformation, and the tendency of some approaches to remain descriptive without social or political depth. By requiring explicit compositional decisions and written rationale, the studio addresses these risks and turns representational making into an articulated intellectual practice.[21]

Analogue-digital hybridity in contemporary studio work

A key contribution of this model is its deliberate hybrid workflow. Students rely on digital tools for archival search, scanning, retrieval and, where relevant, georeferenced comparison. They then engage analogue or analogue-inflected synthesis through manual drawing and tactile compositional operations that slow down interpretation and force selective judgement. Digital refinement can follow for alignment, annotation and publication. This sequence creates productive friction. Rather than accepting software outputs as self-evident, students must continually decide how raw material becomes legible argument.[22]

Digital systems increase accessibility and interactivity but do not fully reproduce the expressive and embodied qualities of manual practice. Integrated frameworks balance historical knowledge with digital advancement. The studio model can be read as an operational response to that call, demonstrating how hybrid methods can be embedded in early urban education without sacrificing precision or conceptual ambition.[23]

DISCUSSION

The evidence assembled here suggests strong convergence between contemporary cartographic scholarship and this pedagogical practice. Both acknowledge that mapping has evolved through intertwined technological and artistic trajectories; both recognize that digital abundance requires renewed critical literacy; and both point towards mixed-media methods as the most productive way forward. At the same time, several limits remain and should be addressed explicitly.[24]

There is a persistent risk of formalism in collage-based work if compositional quality is not anchored in explicit research questions. Archive dependence may reproduce institutional bias and silence informal or subaltern spatial histories. Morphological emphasis can abstract social relations unless complemented by socioeconomic and political analysis. Assessment frameworks must therefore evaluate technical coherence, source criticism, analytical depth and representational clarity together, rather than privileging surface finish.[25]

These limits, however, do not weaken the method; they define the terms of its rigorous use. When supported by critical discussion and methodological transparency, cartographic collage functions as a robust pedagogical instrument that links historical inquiry, spatial analysis and projective thinking.[26]

While the two exercises already establish a strong epistemic progression from description to interpretation, their full pedagogical value becomes clearer when read against wider debates on disciplinary literacy in architecture. In many schools, students are trained to produce drawings that are formally correct but analytically thin, or analytically ambitious but graphically incoherent. The pairing of territorial mapping and historical collage creates a middle ground in which representation is required to carry argument. The map is no longer a neutral container of information, and the collage is no longer an aesthetic afterthought. Both become vehicles for explicit reasoning. This is particularly relevant in early undergraduate years, where students are still acquiring the habits through which they will later approach complex design and planning questions. By insisting on selection, hierarchy and compositional intention, the method teaches students to justify their visual decisions in relation to urban evidence. This often changes the quality of discussion: from generic comments on style and toward concrete questions of source reliability, scalar appropriateness, and historical interpretation. In that sense, the studio does not merely produce better drawings; it produces better arguments through drawing.[27]

An additional strength of the sequence lies in how it addresses memory and transformation without collapsing into heritage nostalgia. Historical maps are treated as active documents of urban process rather than as sentimental artefacts. Students are encouraged to identify what persists, what disappears, and what reappears in altered form, with attention to infrastructures, water systems, property geometries and peripheral growth. This approach supports a rigorous reading of continuity and rupture, which is crucial for contemporary urban practice in contexts shaped by climate pressure, infrastructural obsolescence and social recomposition. When students trace buried streams, erased boundaries or displaced productive landscapes, they begin to see that urban form is both material and political. The city becomes legible as a layered construct produced by successive regimes of decision making, investment and regulation. Cartographic collage can then operate as an instrument for making those regimes visible, especially when conventional present-day base maps conceal them. In this way, the pedagogy contributes not only to formal literacy but to critical urban consciousness, helping students understand how representation participates in the politics of what cities remember and what they forget.

The digital dimension of the exercise also deserves fuller consideration. Current students are often highly proficient in image editing and geospatial interfaces, yet this fluency can mask methodological fragility. Easy overlay functions can create an illusion of analytical depth where there is only visual accumulation. The studio counters that tendency by requiring each overlay or fragment to be tied to a question. Why is this historical moment being selected? What transformation does this juxtaposition make legible? Which absence is being highlighted through omission? Such questions reposition software as a means rather than an end. They also align with the concern that technical innovation should be accompanied by stronger frameworks for interpretation and evaluation. In practical terms, this can be reinforced through short methodological statements attached to each student plate, where the criteria of source choice, registration decisions and compositional logic are explicitly stated. This small addition has substantial pedagogical payoff, because it turns tacit process into examinable knowledge and helps tutors assess work on common analytical grounds. Over time, such documentation can produce a comparative archive of methods, allowing future cohorts to learn from prior experiments without copying their graphic outcomes.[28]

A further point concerns interdisciplinarity. The method can be productively connected to historical geography, environmental humanities and digital heritage research. Students working on river corridors, railway lands or agrarian edges often encounter questions that exceed architectural morphology and require engagement with legal, ecological and socio-economic records. Collage can serve as a framework for assembling these heterogeneous materials, provided the representational grammar remains clear. This suggests that cartographic collage may be especially useful in schools seeking to bridge design studios with research-led seminars. Rather than positioning theory and practice as separate domains, the approach allows theoretical constructs such as palimpsest, trace and assemblage to be tested through concrete graphic operations. Conversely, graphic outcomes can generate new research questions, for example about differential rates of urban change, infrastructural persistence or patterns of selective erasure across districts. In this reciprocal model, student work is not merely pedagogical output; it becomes exploratory knowledge that can inform broader academic and civic conversations.[29]

Finally, the sequence has implications for assessment culture and institutional publication. When large cohorts produce map series under shared protocols, schools can curate the results into open repositories that document changing urban conditions over time. This cumulative publication practice is valuable for at least three reasons. It creates transparency about pedagogical standards, it supports longitudinal comparison across years, and it gives public visibility to student-generated territorial knowledge. However, to avoid reducing publication to a showcase of aesthetic variety, editorial frameworks should include concise reflective texts explaining each project's analytical thesis and methodological limits. Such framing reinforces the central claim of this paper: representation is an argumentative act. If adopted consistently, this model can renew the public role of architectural education by presenting student cartographies as grounded contributions to debates on urban futures. In periods of accelerated transformation, when cities are restructured by infrastructural transition, climate adaptation and contested development, the capacity to read and recompose territorial evidence is not ancillary. It is a core professional competence. Expanding the paper's argument, one can therefore say that teaching cartographic collage is not simply teaching a technique; it is teaching how to think historically, critically and projectively in the face of complex spatial change.[30]

At ETSAB-UPC, this curatorial potential has been consolidated through an open-access practice of collecting and publishing student cartographies which assembles annual cohorts of studio work into a cumulative archive. Teaching publications linked to the Urbanística 2 course have been made publicly available since at least 2016, supporting longitudinal comparison and providing a shared reference for subsequent cohorts.[31]

CONCLUSION

This paper has argued that combining territorial map drawing and historical cartographic collage offers a strong framework for teaching urban analysis in contemporary architectural education. The first exercise develops structural reading and scalar synthesis. The second introduces temporal reasoning, source criticism and interpretative authorship. Together they transform representation from technical output into epistemic practice.

Cartographic history is best understood not as straightforward technological replacement, but as an evolving field in which manual and digital practices continually reconfigure one another. Current digital infrastructures expand access and precision, yet they also intensify the need for critical selection and explicit argument. Collage, in this context, should be understood not as stylistic effect but as a method for constructing historically layered urban knowledge.[32]

Future development should include systematic cross-cohort evaluation, clearer comparative testing of manual and digital variants, and stronger incorporation of social and political datasets alongside morphological materials. Even with these improvements pending, the central point stands: drawing maps and cutting cartographies are not peripheral graphic exercises. They are rigorous ways of learning to see the city as layered, contested and unfinished, and of preparing students to think and act with responsibility in conditions of spatial complexity.[33]

NOTES

[1] Manuel de Solà-Morales, “The Culture of Description,” *Perspecta* 25 (1989)..
[2] Boris Mericskay, “Rethinking Cartography on the Geoweb”
[3] Karen Severud Cook, “The Historical Role of Photomechanical Techniques in Map Production,” *Cartography and Geographic Information Science* 29(3) (2002): 137–154.
[4] Martin Dodge, Rob Kitchin, and Chris Perkins, “Introductory Essay: Technologies of Mapping”.
[5] Denis Cosgrove, “Maps, Mapping, Modernity: Art and Cartography in the Twentieth Century,” *Imago Mundi* 57(1) (2005): 35–54.
[6] Tatsiana Zhurauliova, “Cartography as Collage/Collage as Cartography,” *American Art* 34(3) (2020): 72–91.
[7] Ruochen Si, Masatoshi Arikawa, Min Lu, and Hideki Kaji, “Timeline Collaging as an Extension of Map Collaging Using Geo-referencing and Time-referencing” (2017).
[8] Cosgrove, “Maps, Mapping, Modernity,” 35–54.
[9] Colin Rowe and Fred Koetter, *Collage City* (Cambridge, MA: MIT Press, 1978).
[10] Juhani Pallasmaa, “Hapticity and Time: Notes on Fragile Architecture,” *The Architectural Review* 207(1239) (2000): 78–84.
[11] Zhurauliova, “Cartography as Collage/Collage as Cartography,” 72–91.
[12] This teaching and research exercise has been coordinated by the author of this paper since 2016.
[13] James Brotton, *A History of the World in Twelve Maps* (London: Penguin Books, 2013), 4.
[14] Remi Petitpierre, Johannes H. Uhl, Isabella di Lenardo, and Frédéric Kaplan, “A Fragment-based Approach for Computing the Long-term Visual Evolution of Historical Maps” (2024).
[15] Beatrice Vaienti, Isabella di Lenardo, and Frédéric Kaplan, “Exploring Cartographic Genealogies through Deformation Analysis: Case Studies on Ancient Maps and Synthetic Data,” *Cartography and Geographic Information Science* (2024): 1–21.
[16] Solà-Morales, “The Culture of Description,” 16–25.
[17] Eulàlia Gómez-Escoda, “Una gramática visual urbana,” in *Enseñar urbanismo: apuntes y experiencias*, ed. C. Crosas, Á. Clua, I. Aquilué, and M. Pesoa (Málaga: Recolectores Urbanos Editorial, 2023), 31–45.
[18] Si et al., “Timeline Collaging,”.
[19] Beata Medynska-Gulij, David Forrest, and Thomas P. Kersten, “Cartography and Geomedia in Pragmatic Dimensions,” *ISPRS International Journal of Geo-Information* 12(8) (2023): 326.
[20] André Corboz, “Le territoire comme palimpseste,” *Diogène* 121 (1983): 14–35.
[21] Inessa Sidorina, Natalia Pozdnyakova, Evgeny Panidi, Tatiana Andreeva, and Maria Litvinova, “Integration of Traditional and Modern Methods in GIS-based Mapping” (2019).
[22] Medynska-Gulij, Forrest, and Kersten, “Cartography and Geomedia in Pragmatic Dimensions,” 326
[23] Claire Portal, “Cartography and Photography: Connivances and (Un)certainties of Two Iconographic Mediums,” *International Journal of Cartography* (2024).
[24] Sidorina et al., “Integration of Traditional and Modern Methods in GIS-based Mapping”.
[25] Si et al., “Timeline Collaging”.
[26] Medynska-Gulij, Forrest, and Kersten, “Cartography and Geomedia in Pragmatic Dimensions,” 326.
[27] Claire Portal, “Cartography and Photography”.
[28] Sidorina et al., “Integration of Traditional and Modern Methods in GIS-based mapping”.
[29] Si et al., “Timeline Collaging”.
[30] Medynska-Gulij, Forrest, and Kersten, “Cartography and Geomedia in Pragmatic Dimensions,” 326
[31] Maria Rubert de Ventós and Eulàlia Gómez-Escoda, Cities: Teaching Publications and Course Archives (Laboratori d’Urbanisme de Barcelona [LUB-UPC]),
[32] Zhurauliova, “Cartography as Collage/Collage as Cartography,” 72–91.
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BEYOND THE SCREEN: HEURISTIC AND EMBODIED STUDIO PRACTICES TO COUNTER DIGITAL ENTRENCHMENT AND SUPPORT PROFESSIONAL AGENCY, GROUNDED IN SOU FUJIMOTO'S ARCHITECTURE IS EVERYWHERE APPROACH

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INTRODUCTION

Within architectural education, cognitive repatterning associated with sustained digital immersion intersects with longstanding representational biases that privilege polished visual output, and studio cultures increasingly reward novelty aligned with prevailing stylistic tropes, tending to produce visually seductive objects detached from spatial inhabitation and material reality. Under these conditions, software predominant design pedagogies can over-proceduralize design thinking, externalizing judgment before designers have developed internal heuristic systems capable of evaluating spatial relations and material performance. When digital tools are privileged as primary generators during formative stages of architectural education, they risk progressive narrowing of embodied architectural reasoning which depends on physically grounded projection into speculative space.

Research across cognitive and media sciences suggests that extended immersion in screen centered environments reshapes habits of attention and problem solving, impairing the cognitive capacities underlying architectural judgment.[1] When insufficiently integrated with multisensory and enactive experience, digitally saturated instruction constrains exploratory reasoning and conceptual synthesis producing early-stage professionals who struggle to navigate the complex multi-layered conditions of practice.[2]

Contemporary studies of digitally accelerated learning environments identify increased cognitive load alongside weakened conceptual integration. Within architectural education, this often manifests as premature formal stabilization and reliance on software-driven decision-making before students have cultivated internal evaluative frameworks.[3]

Embodied Cognition Theory offers a countervailing perspective of design learning, foregrounding cognition as an enacted process that emerges through sensorimotor engagement with environments through which architectural understanding persists beyond immediate tasks.[4] Perception and action are constitutive of thinking itself, enacted through bodily participation, and architectural reasoning develops through iterative embodied projection into speculative space.[5]

This study examines a situated studio framework grounded in Embodied Cognition and informed by a pedagogical reading of Sou Fujimoto's *Architecture Is Everywhere* approach, interpreted here as a

Dual Heuristic System in which material operations and spatial-experiential intentions remain in continuous negotiation.

EMBODIED THEORY OF MIND

This study introduces *Embodied Theory of Mind (EToM)* as an original theoretical construct grounded in *Theory of Mind* and *Embodied Cognition*, describing how architectural judgment develops through embodied interaction with spatial and material consequence and the anticipation of spatial effect.

In cognitive science, Theory of Mind refers to capacities to anticipate intention and consequence within situated contexts. Here, that capacity is extended for architecture pedagogy, with EToM described as the gradual formation of evaluative capability through embodied engagement with spatial and material conditions. Embodied Cognition Theory challenges Cartesian dualism by rejecting the separation of mind from body. Rooted in phenomenology and ecological psychology, it understands perception and action as constitutive of cognition with learning that emerges through multisensory interaction with environments and material conditions.

Within this purview, architectural understanding develops through bodily participation in making itself, as developing spatial configurations are negotiated through material resistance and instrumental action. Design reasoning stabilizes unevenly through this reciprocal process, allowing consequence to be anticipated prior to formal resolution.

Embodied Cognition identifies *Affordances* as relational possibilities disclosed through engagement, while *Enaction* describes how designers enter into those possibilities through action. In architectural practice, this coupling is enacted through *Exploratory Procedures*: iterative acts of making that attune perception to material response while refining technique. Spatial potential becomes perceptible, and design trajectories are recalibrated as projects evolve.

From these recursive engagements emerge *Embodied Heuristic Systems*: action-guiding cognitive structures that organize attention and shape projective orientation during design activity. These systems develop through sustained interaction with tools, materials, and evolving architectural intent, allowing designers to refine spatial cognition through multisensory feedback. Over time, such systems cohere into an internally organized mode of reasoning.

EToM codifies this accumulation of embodied discernment. It names the formation and stabilization of anticipatory insight that emerges through recursive engagement during the process of design. Architectural reasoning is structured through Dual Heuristic Systems that coordinate instrumental processes of making with spatial, ecological, and experiential qualities of inhabitation.

A SITUATED READING OF SOU FUJIMOTO'S ARCHITECTURE IS EVERYWHERE

With respect for the richness and internal complexity of Sou Fujimoto's oeuvre, this study advances an imperfect model: a reductive distillation articulated with deliberate restraint, positioned as one among many possible theoretical approximations.

This reading emerged from consecutive Fujimoto-themed studios conducted over a three-year period and is oriented toward pedagogical integration. Fujimoto's work is approached as a lens through which architectural reasoning can be observed in formation, particularly as designers develop judgment through embodied engagement with indeterminate spatial conditions.

Architects have historically sourced diverse heuristic devices across visual art, collage, music, and film. Le Corbusier developed architectural thinking through painting and compositional studies. Bernard Tschumi employed collage to construct spatial narrative in *The Manhattan Transcripts*. Daniel Libeskind and Rem Koolhaas turned to music and cinema to structure architectural ideas. Fujimoto's approach diverges by working directly with objects that already contain spatial

information, provoking designers to uncover architectural possibility through tangible, three-dimensional exploration.

Architecture Is Everywhere Models

Fujimoto's *Architecture Is Everywhere* models foreground found objects as heuristic cognitive instruments for latent architectural propositions. Unlike two-dimensional prompts like photography or collage, these objects possess inherent three-dimensionality and material presence. Their internal structure carries spatial implication. Architectural potential emerges through embodied experimentation.

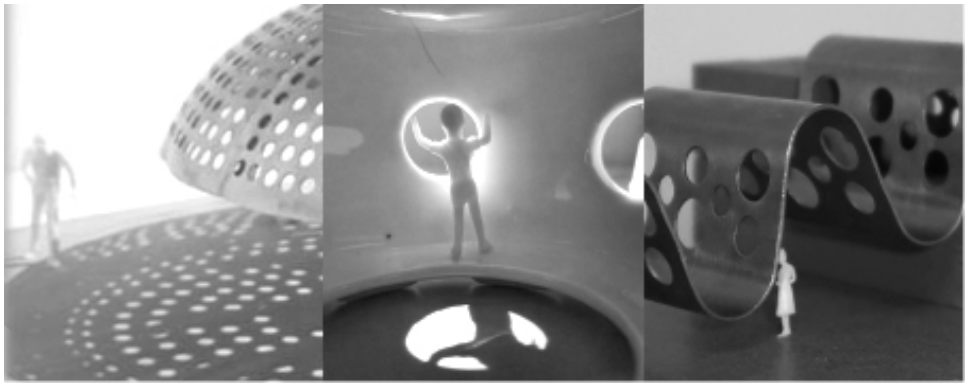


Figure 1. Found Object Heuristics: Vegetable Steamer, Ashtray, Taco Holder

Initially, objects remain open-ended, even as an implicit finder's hypothesis invariably exists. The question "how is this architecture?" arises immediately and is deliberately left unresolved. Potential translations into architectural schemes are perturbed through free associative exploration, including modulations in orientation and the introduction of scaled human figures to provoke imaginative readings of spatial potential. Architectural implications vary as perception oscillates and intuits.

These found object models function as the initiating condition for embodied design reasoning, preceding formal resolution while catalyzing heuristic systems that carry forward through subsequent stages of translation.

As a result, the *Architecture Is Everywhere* approach yields a dispersed field of possibilities, with differentiation emerging prior to formal consolidation and before project-level hierarchies take hold.

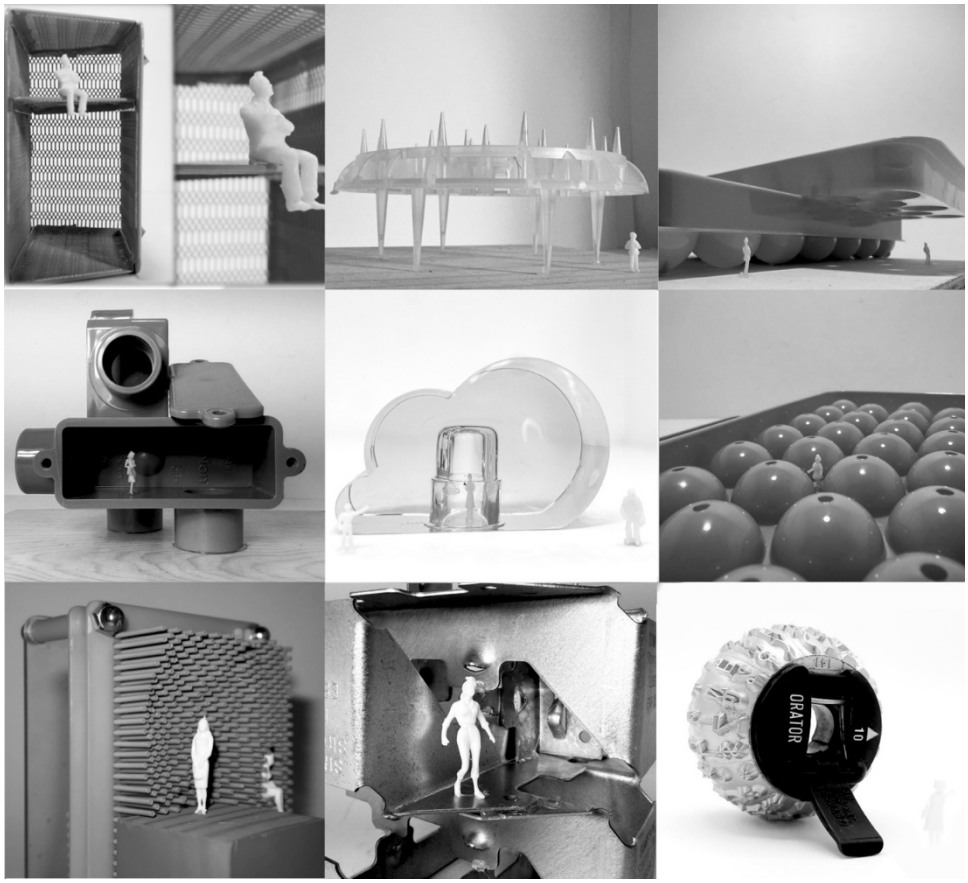


Figure 2. Found Object Heuristics

Dual Heuristic Systems and Constituent Heuristic Sets

Through analysis of Fujimoto's models, drawings, installations, exhibitions, and built and unbuilt projects, an approximate design logic can be inferred. Interpreted through Embodied Cognition, this logic operates through two interdependent heuristic systems that remain co-present throughout design development.

Heuristic System 1: Design Objects, Instruments, Materials, and Techniques

This system concerns instrumental choices shaping architectural realization across scales. It operates through heuristic sets that organize translation across media while sustaining openness during development:

Found Objects [Architecture Is Everywhere-Models]

Manufactured or naturally occurring objects treated as latent architectural propositions

Translation-to Architectural Schemes

Diagrams and models that stabilize emerging spatial logics while remaining responsive to revision

Translation to Site and Construction

Representations situating architectural design intent within site conditions and construction logics

Heuristic System 2: Spatial, Ecological, and Experiential Qualities

This system organizes atmosphere, inhabitation, and environmental effect. In Fujimoto's work, these qualities operate as generative drivers:

Flora, Atmosphere, Terrain

Architecture understood as continuous with landscape

Designing in Section

Spatial organization developed through vertical relationships: split levels, interior and exterior mezzanines, decks, catwalks, and atria

Material Inversion and Transposition

Spatial qualities derived from one material condition re-enacted through another

Productive Misalignment (SNAFU)

Deliberate misalignment of familiar conventions to provoke perceptual recalibration

Prepositional Gardens

Planted spaces distributed through relational logics including between, within, above, and through habitation volumes

Memes of Domesticity

Abstracted archetypological forms and boundary conditions deployed as spatial references

Microbiome Hamlets

Architecture organized as a field condition of smaller volumes with interstitial spaces supporting circulation and encounter, operating as a village-scale ecology within a single building.

"*Forest-like Architecture may be something between artificial and natural; perhaps when we speak about a cloud-like architecture, we could imagine architecture made up of air and light rather than a wall. Mountain-like architecture may dial up a new relationship between the human body and the building."*

-Sou Fujimoto

Dual Heuristic Systems Negotiation

Architectural reasoning develops through ongoing negotiation between these systems. Each design decision anticipates how instrumental choices shape spatial experience and how experiential intentions demand material resolution.

The *Architecture Is Everywhere* approach prioritizes embodied engagement; it amplifies divergent cognitive trajectories even when designers begin from shared objects and prompts. Translation depends on bodily action and perceptual orientation. Individuation emerges through idiosyncratic participation.

Together, these dual heuristic systems and constituent subsets operate in recursive loops, enabling architectural reasoning to emerge through embodied engagement.

STUDIO DESIGN AS ENACTED THEORY

The studio operated as an applied environment for the development of Embodied Theory of Mind (EToM). The Dual Heuristic Systems functioned as interdependent conceptual structures enacted through material practice. Architectural reasoning emerged through recursive translation, with perception and action gradually organizing discernment over time.

The studio's site and programmatic parameters, combined with the strategic sequencing of design media, were deliberately calibrated to establish tangible conditions for bodily engagement within architectural inquiry. Students' Fujimoto-emulated *Architecture Is Everywhere* models provided the initiating heuristic condition. This phase activated embodied capacities capable of sustaining architectural orientation as projects accumulated technical constraint and spatial consequence.

Design Brief and Programmatic Conditions

Students designed an Apart-Hotel complex comprising twelve to eighteen multi-room units within Lexington's Distillery District. The hybrid typology combined short- and long-term inhabitation, demanding sectional differentiation, operable envelopes, integrated planting systems, and mediated thresholds between public and private domains. Parking was semi-concealed beneath a porous daylight permitting landscaped ground plane. Circulation extended vertically and laterally across layered spatial zones.

The Apart-Hotel was selected strategically. Its temporal variability and mixed-use character introduced overlapping pressures that demanded spatial negotiation in place of singular formal resolution. The program anticipated varied durations of stay alongside diverse modes of occupation, producing tensions between privacy and publicity that called for deliberate architectural mediation. These demands align closely with Fujimoto's sectional logic and distributed thresholds. The site intensified this condition through temporally layered patterns of movement and event-based occupation, compelling students to anticipate fluctuating densities and atmospheric change.

The Dual Heuristic Systems were activated in parallel. One system engaged material assembly, construction logic, and representational development. The other engaged atmosphere, inhabitation gradients, and environmental integration. Design evolved through continuous negotiation between instrumental choice and experiential anticipation.

Object-Based Heuristics and Early Divergence

The studio design process began with object-based heuristics. Found object *Architecture Is Everywhere* models were treated as materially active systems containing latent spatial potentials. At this stage, emphasis shifted away from producing visually resolved artifacts to projecting oneself into speculative space. Students placed scaled figures into object configurations and imagined themselves as those figures. The guiding question moved from "How does this look?" to "How would this feel?" Designers described anticipating airflow through apertures and compression-release across thresholds and elevated platforms. Architectural reasoning began to operate as empathy projection, orienting decisions toward future inhabitation.

Divergence appeared immediately. Even when students operated within the same heuristic framework established by the studio brief, perceptual emphasis varied widely. Each designer interpreted spatial potential through individualized sensorimotor engagement, producing distinct architectural hypotheses from shared prompts.

Recursive Translation Across Media

Design development proceeded through recursive translation. Through sketching, insights generated from object engagement were translated into emerging architectural conditions and episodes. Each translation reframed spatial understanding while preserving continuity of evolving logics.

Sketching functioned as a mediating practice, supporting movement between abstraction and material specificity without premature stabilization. Imprecision often generated productive deviation. Minor shifts in proportion or alignment opened unexpected spatial readings, sustaining exploratory momentum while reinforcing the provisional character of early proposals.

Students frequently returned to earlier modes of engagement as new spatial potentials became perceptible through later representations. Digital modeling followed extended embodied exploration with physical models and sketches. When introduced, digital tools served to stabilize and test developing spatial notions that had already undergone iterative heuristic development. By delaying digital formalization, this sequencing preserved exploratory duration and reduced premature closure.

Across this sequence, discernment gradually consolidated. The architect's Embodied Theory of Mind emerged through an organization of perception over time, in which memory and anticipation informed ongoing action.



Figure 3. Heuristic Found Object Models

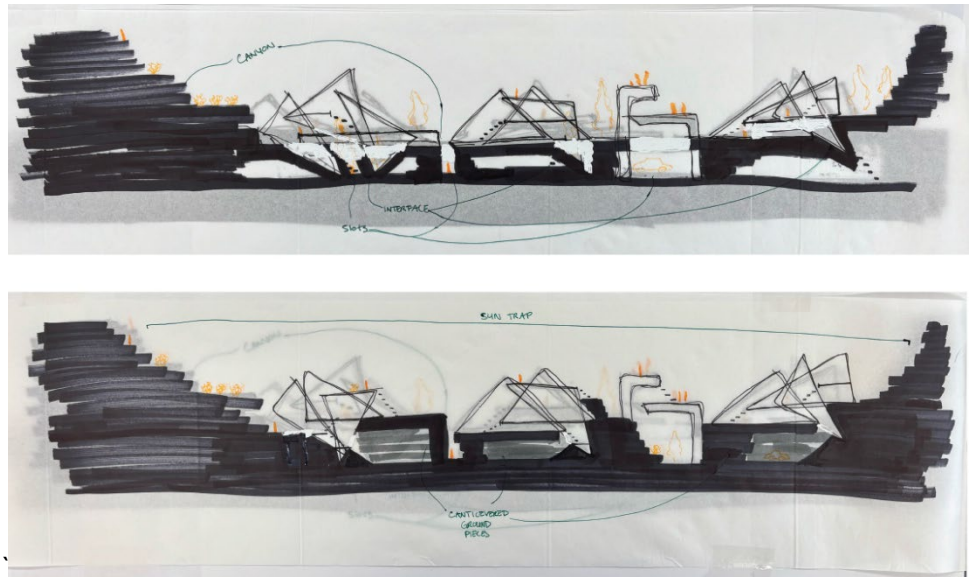


Figure 4. Translation Across Media, Heuristic Found Object Model to Sketches

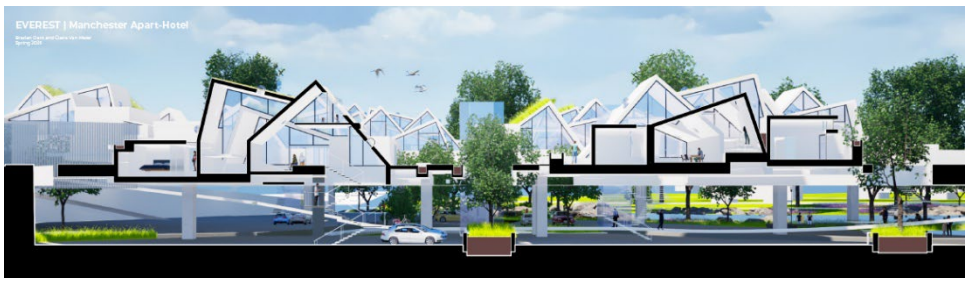


Figure 5. Translation Across Media, From Sketch to Interim Section



Figure 6. Final Detailed Section as Integrative Medium

SITUATED PEDAGOGICAL EVIDENCE: SECTIONAL MEDIA AND DUAL HEURISTIC DEVELOPMENT

Architectural development is examined through *Spatial Reasoning Across Media*, *Adaptive Progression Under Constraint*, *and Individuation Within Shared Heuristic Structures*. These criteria extrapolate from embodied and situated learning research, which understands cognition as the progressive organization of experience through sensorimotor engagement. Architectural understanding develops when spatial intentions remain legible across representational transformations and when earlier design commitments continue to organize subsequent decisions as complexity increases.[6]

Plural Heuristic Objects and Translation Stability

Students began with multiple *Architecture Is Everywhere* object models and sustained engagement with them over several weeks. These objects were treated as nascent architectonic systems whose spatial potentials were explored through bodily engagement and sketch-based translation.[7] Early design work remained deliberately physical and iterative.

Sketching functioned as a heuristic instrument capable of sustaining internal design dialogue. Its pace allowed multiple spatial hypotheses to surface and recombine before formal commitments were required. Drawing operated elastically, allowing emerging schemes to be destabilized and redirected as new spatial readings emerged. Digital modeling, introduced later, consolidated spatial knowledge that had already acquired internal coherence and served to stress-test structural and spatial viability. Designers returned to sketching tactically throughout the process to recalibrate emerging decisions.

Across midterm work, early schematic intentions remained legible within later drawings and models. Initial sectional intuitions accumulated developmental inertia, shaping subsequent organizational and envelope decisions. This persistence reflects internally anchored evaluative frameworks that carry forward across representational translations, maintaining conceptual continuity as projects gain technical and spatial specificity.

Section and Video as Integrative Media

The design process culminated in large-format longitudinal sections developed in parallel with time-based video walkthroughs. These sections required resolution of structural depth, light penetration, envelope articulation, and spatial continuity within a single architectural field. Designing in section produced exchanges across levels, where decisions in one region generated consequences elsewhere, demanding coordinated reasoning.

Students repeatedly printed and revised their sections, using the wall-mounted drawings as sites of embodied critique. Sketch overlays returned at key moments of revision and refinement. Spatial consequence and material feasibility were negotiated through gesture and shared physical reference. Digital models remained operative but were continuously tested against the clarity demanded by the large scaled sectional cut.[8]

The video walkthrough introduced projected movement and temporal occupation. Circulation sequences and daylight scenarios were simulated to anticipate inhabitation under changing conditions. This temporal projection reinforced enactive spatial reasoning, allowing emerging decisions to be evaluated through imagined bodily navigation.[9] Together, section and video intensified negotiation between instrumental construction and experiential anticipation within the Fujimoto derived Dual Heuristic Systems.



Figure 7. Video Walkthrough Frames [Temporal Reasoning]



Figure 8. Final Hand Made Model

Individuation Within Shared Heuristic Structures

Comparative sectional excerpts reveal substantial divergence despite shared prompts, site, and program. Spatial organizations vary in density and distribution. Some projects concentrate habitation around infrastructural cores, while others disperse them through layered terraces or interwoven volumes. Differences emerge through distinct resolutions of threshold and adjacency.

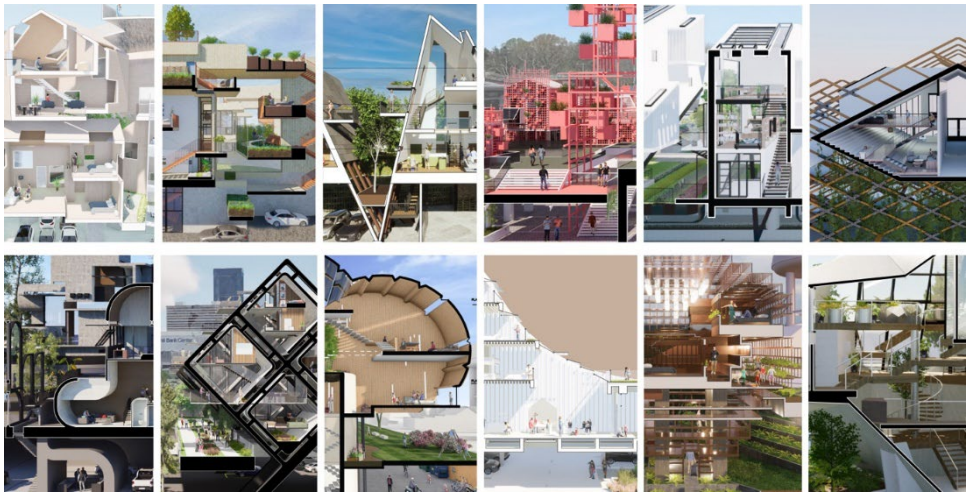


Figure 9. Cropped Sections Samples, Individuation Under Shared Conditions

Embodied accounts of cognition emphasize that reasoning arises through coupled interaction between organism and environment. Variation under shared conditions is expected, as interpretation is shaped by personally oriented bodily orientation and iterative engagement with constraint. Shared heuristic systems stabilize process while amplifying differentiation.

Across the studio work, bodily informed architectural capacity was progressively developed and articulated. Students integrated structural, environmental, and programmatic demands while maintaining continuity with earlier conceptual and spatial commitments. The capacity to adapt under constraint while preserving conceptual trajectory reflects the formation of an Embodied Theory of Mind capable of organizing complexity.

CONCLUSION

Research across embodied cognition and learning sciences provides a foundation for understanding architectural reasoning as an enacted process that develops through organism-environment coupling. Work by Varela and Thompson established cognition as emergent through interaction, while O'Regan and Noë and Chemero further articulated perception and affordance as relational and action oriented.[10] These perspectives align with architectural accounts that locate spatial understanding through embodied engagement with material conditions.

Within architectural discourse, this study extends pedagogical trajectories that foreground embodiment by advancing it as an active pedagogical mechanism within architectural learning. Building on Pallasmaa's advocacy for multisensory architectural experience, the work demonstrates how architectural judgment forms through sustained interaction with materials, spatial relations, and design practices.[11]

A central contribution of this work is the articulation of *Embodied Theory of Mind* as an imperative cognitive capacity within architectural education. Through sustained engagement with heuristic systems tuned for embodied interaction, students cultivate internally coherent modes of reasoning capable of anticipating consequence and navigating material constraint under uncertainty, shifting design motivation away from visually seductive artifacts toward projected inhabitation, though the two are not necessarily mutually exclusive.

Within this context, digital tools function as stabilizing instruments within an already active embodied cognitive ecology. Design instruments operate as heuristic sets, each activating distinct affordances while preserving continuity as intent carries forward across design phases. By delaying digital

formalization, the studio methodology preserves exploratory duration and resists premature formal resolution.

The pedagogical approach also contributes to post-digital architectural education by situating heuristic systems as mediating structures between embodied exploration and computational representation. Movement between provisional making and reflective revision allows architectural cognition to develop under conditions of indeterminacy through embodied recalibration. This process preserves disciplined play. Students experiment, receive feedback, and adjust their work through iterative engagement, allowing architectural intelligence to emerge through sustained negotiation with uncertainty.

The implications of this work extend beyond the specific studio environment. The dual heuristic scaffold and project typology presented here operate as an open pedagogical system: the underlying structure can be retained while variables including site, program, and material systems may be reconfigured over time. In this sense, the approach offers a transferable method for cultivating robust architectural reasoning.

Embodied Theory of Mind is articulated here as a cognitive capacity upon which architectural practice depends. This study argues that architectural education must preserve the conditions of embodied spatial reasoning through which architectural discernment and professional agency develop, alongside digital and computational proficiency.

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ONTOLOGY, TAXONOMY, AND PHENOMENOLOGY: A PHILOSOPHICAL FRAMEWORK FOR AI IN ARCHITECTURAL PEDAGOGY

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INTRODUCTION

This paper advances a philosophically mediated framework for the integration of artificial intelligence (AI) in graduate architectural design studios, with particular relevance to resource-constrained environments such as historically Black colleges and universities (HBCUs). Drawing on Hegelian ontology (thingness and becoming), taxonomic inference from morphological evidence, and phenomenological disclosure of experiential intent, the framework positions AI as a bounded epistemic participant within a triadic consultancy (student–faculty–AI), governed by the project parti. Four constrained stages—Ontology, Taxonomy, Translation, and Phenomenology - ensure traceability of claims, preserve student agency, and mitigate risks associated with ungoverned AI adoption. Implemented in a Monteverde, Costa Rica-based research outpost studio, the method extracts behavioral principles from morphological studies of flora, fauna, and geology and translates them into architectural assemblies without recourse to mimetic reproduction. Cohort performance data (Fall 2025, n=13) reveal strong outcomes in early stages and persistent difficulties in locating causal experiential evidence, affirming the necessity of staged philosophical governance. The approach aligns with NAAB criteria for design synthesis and building integration while contributing to AI integration in architectural pedagogy.

Artificial intelligence (AI) is transforming architectural education by reshaping how architecture is taught, imagined, and critiqued. In a graduate program at a historically Black college and university (HBCU), where limited resources constrain travel and external critiques, AI serves as an equalizer and catalyst for reexamining authorship and pedagogy.[1] This paper positions AI not merely as a representational tool but as an epistemological agent that reconfigures dialogues among students, educators, and knowledge domains.[2]

Anchored in philosophy, the studio adopts ontology, taxonomy, and phenomenology as the mediating framework for AI's influence. AI operates as a collaborator in a triadic consultancy—students, faculty, and AI—governed by the parti, which functions as an arbitration device, returning project governance to conceptual ideas rather than tool outputs or individual ownership. Operationally, AI augments textual research, expands source synthesis, and performs coherence readings across

drawings. Philosophically, it elicits questions of being, classification, and lived experience, reframing design as rigorous inquiry rather than imitation.[3]

A Monteverde, Costa Rica-based research outpost studio exemplifies this method. Students deploy AI to produce and analyze morphological studies of flora, fauna, and geology, extracting behavioral principles through relational analysis rather than visual reproduction. This pedagogy liberates design from mimicry toward principled assimilation, drawing on Hegelian notions of thingness (Dingheit) and becoming (Werden).[4] In the *Science of Logic*, becoming emerges as the dialectical unity of Being and Nothing, a process of transformation rather than fixed identity.[5] In the *Phenomenology of Spirit*, thingness denotes a thing's unified essence, disclosed through internal contradictions and relational multiplicity beyond sensory attributes.[6]

Applied here, morphological analysis distills an organism's thingness—its immanent behavioral logics—which students then translate into architectural principles. AI participates in this process not by generating form directly but by surfacing contradictions between raw morphological evidence (e.g., lattice structures, porosity gradients) and potential architectural translations, thereby functioning as a dialectical provocateur. Students must confront these tensions, verify AI-suggested relations against primary sources, and resolve them through iterative synthesis, ensuring that dialectical movement remains student-driven rather than tool-dominated.[7]

This Hegelian lens ensures that AI does not dominate form-making; instead, it sustains dialectical tension—students confront contradictions between morphological evidence and architectural translation, resolving them through verification. The result is design as a becoming process, where principles emerge from relational essence rather than imposed aesthetics.

The framework thus yields a reflective pedagogy in which AI and philosophy mutually constitute the learning environment: AI broadens exploratory scope, while philosophy safeguards relations among technology, authorship, and cultural agency.[8]

The method unfolds across four constrained stages (Figure 1), supported by explicit risk controls (Table 2) and a traceable evidence chain (Figure 2).

Stage	Core question	Student artifact	AI role (allowed)	Governance rule
Ontology	What exists? What can be claimed?	Entity map + constraints list + source log	Suggest entities/relations; summarize sources	Every claim must be verified + logged
Taxonomy	How does morphology become principle?	Morphology plates + extracted logics	Assist clustering; propose categories/labels	Evidence-first; avoid appearance-copying
Translation	How do principles become architecture?	Parti logic + modular rules + assemblies	Coherence reading across section/axon	Faculty validates; rules must be traceable
Phenomenology	How is intent proven as experience?	Section-located moments + atmosphere notes	Flag contradictions; checklist prompts	AI cannot grade; evidence must appear on sheets

Figure 1. Framework map (Ontology → Taxonomy → Translation → Phenomenology) constraining AI in studio pedagogy

CURRICULAR PLACEMENT AND ACCREDITATION ALIGNMENT

The framework is implemented in a graduate design studio within the NAAB-accredited Master of Architecture curriculum, targeting ability-level synthesis (SC.5: Design Synthesis) and integration (SC.6: Building Integration).[9] In NAAB terms, SC.5 requires evidence that students can make design decisions while synthesizing user requirements, regulatory requirements, site conditions, accessible design, and measurable environmental impacts; SC.6 requires evidence of integration across envelope systems, structural systems, environmental control systems, life safety systems, and measurable building performance outcomes.[9]

The triadic faculty–student–AI method accommodates these criteria without reducing the studio to compliance. By bounding AI to supportive roles, the framework keeps architectural judgment—anchored in the parti and its framed ideas and concepts—primary, with students as stewards of the dialectical process. Verification logs, parti arbitration, and rubric-based evidence ensure traceability, supporting NAAB demonstration of synthesis and integration in a resource-limited HBCU context.

CONTEXT: AI, ACCESS, AND GOVERNANCE

As AI permeates studio workflows, access expands but accountability often lags. In HBCU settings, ungoverned AI risks exacerbating inequities: hallucinated claims, homogenized outputs, authorship confusion, and over-reliance on machine critique can undermine student voice and cultural specificity. Governance provides essential scaffolding for credible process, assessment clarity, and preserved agency.

Without constraints, predictable pathologies emerge. Table 1 summarizes key risks and mitigations.

Risk	Mitigation in the Framework
Hallucinated claims / bias	Require source verification; maintain logs; treat AI output as hypothesis until verified
Authorship confusion	AI-use log + reflection statement; decision trail anchored to project rules
Homogenized style	Evidence-first rule set; restrict early image-generation; require traceability morphology → principle → assembly
Over-reliance on AI critique	AI as coherence reader only; faculty review remains final; rubric-based verification (see Figure 7)

Table 1. Risks and mitigations in the framework

METHOD

The method is presented as a four-stage sequence (Figure 1), supported by a morphology-to-assembly taxonomy instrument (Table 1) and evaluated through a cohort-wide verification rubric (Figure 6). Each stage constrains AI use to maintain student agency and faculty oversight.[10]

Ontology compels definition of entities, relations, and constraints, with all claims verified via source logs. Taxonomy requires production of morphological studies from which behavioral principles are inferred without reproducing appearance (Table 2 illustrates evidence-to-logic translation). Translation formalizes principles as project rules and assemblies; AI performs coherence readings across drawings, but faculty validates traceability to parti and evidence. Phenomenology demonstrates experiential intent through located evidence (thresholds, gradients, atmosphere) in drawings and models; AI flags contradictions via checklist prompts but cannot grade or evaluate (Figure 6 rubric).

This staged sequence expands exploration while preserving rigor and accountability.

Morphological Evidence (Diagrammed)	**Inferred Logic (What It Does)**	**Derived Principle**	**Spatial / Assembly Move (Architectural Translation)**
Root lattice / distributed supports	Anchors in saturated soil; distributes load; creates porous undercroft	Elevate + distribute support	Pier/stilt field; modular support grid; undercroft circulation + water passage
Canopy layering / filtration	Filters light; shelters nested ecosystems	Layered filtering	Deep overhangs + multi-layer screens (bamboo / louvers / jalousie)
Porosity gradients / exchange	Regulates air/light through layered openings	Controlled exchange	High/low ventilation paths; calibrated openness
River/tide interface	Cyclical wet/dry renewal; moving threshold	Fluctuation adaptation	Hinged dock thresholds; bridge spans preserving water flow

Table 2. Taxonomy matrix (representative mangrove template)

REPRESENTATIVE PROJECT: MONTEVERDE RESEARCH OUTPOST (MANGROVE / FLORA)

This representative mangrove/flora project illustrates the full triadic workflow in practice, demonstrating how philosophical mediation is enacted across a site-specific intervention in the volatile cloud forest. Figure 2 delineates the faculty–student–AI governance structure, arbitrated by the parti, which returns authority to the controlling idea rather than to any participant or tool output. This circuit—faculty providing evaluative standards, student acting as steward of decisions and revisions, AI functioning as bounded coherence reader—ensures dialectical accountability throughout. Figure 3 traces the evidence chain from morphological input (root lattices, porosity gradients, tidal interfaces) through parti formation to architectural verification in drawings and models. This chain embodies the framework's core commitment to dialectical movement: raw biological evidence is not mimetically copied but dialectically transformed into inferable principles, then rigorously tested and refined against site flux and imposed regularity.

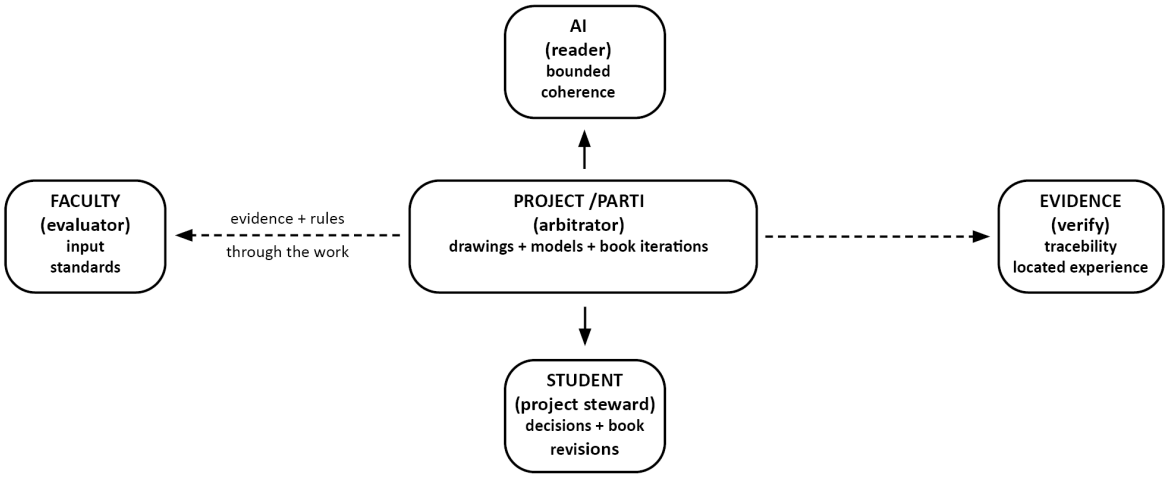


Figure 2. Triadic consultancy workflow (student as steward, faculty as evaluator, AI as bounded coherence reader), arbitrated by project/parti rules and verified through evidence and located experience.

The traceability established in Figure 2 is made concrete in Figure 3, which maps the progression from morphological observation to architectural instantiation, revealing how each stage sustains dialectical tension and prevents unmediated replication. By tracing this chain—morphological input to parti formation to verified assemblies—the figure underscores the framework's insistence on rigorous mediation: biological evidence is dialectically interrogated, transformed into inferable principles, and subjected to iterative refinement against site-specific conditions, ensuring conceptual integrity over mimetic imposition.

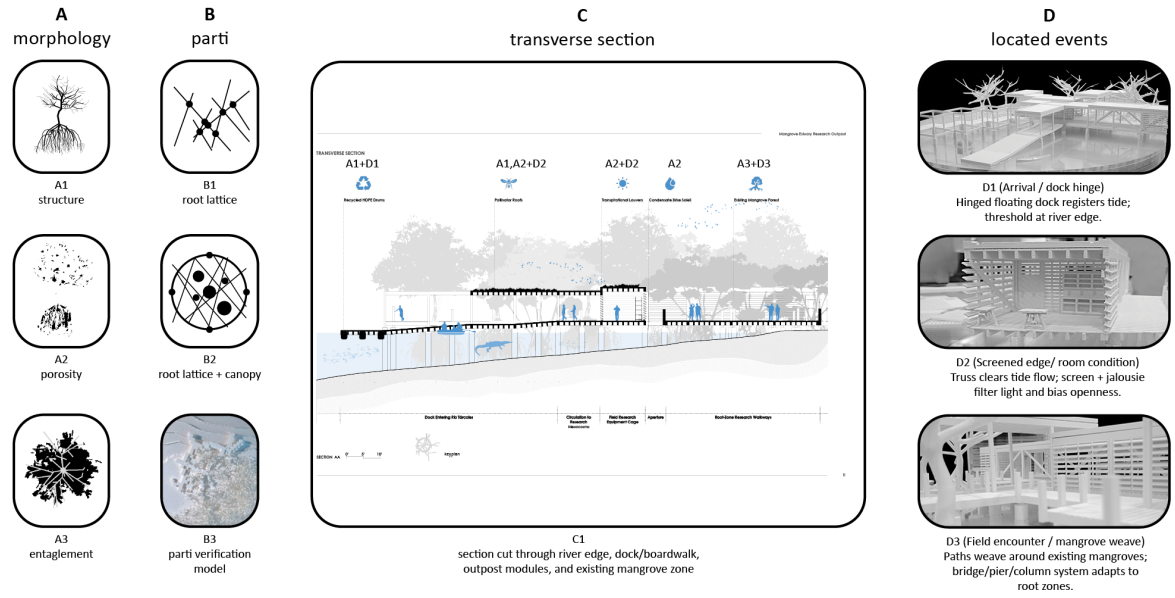


Figure 3. Representative mangrove project evidence chain demonstrating traceability from morphological evidence to architectural verification. (Images: Armaan Dixon (ARCH 5656), Prairie View A&M University, Fall 2025. Figure compiled by the author).

Figure 4 presents the phenomenology sequence plate, locating three experiential moments (arrival, passage, field encounter) within the transverse section and key plan, each tied to specific assembly conditions that produce atmospheric and perceptual shifts. This plate renders the phenomenological stage evidentiary, requiring students to demonstrate—rather than merely describe—how materiality and spatial organization disclose lived experience in the cloud-forest context.

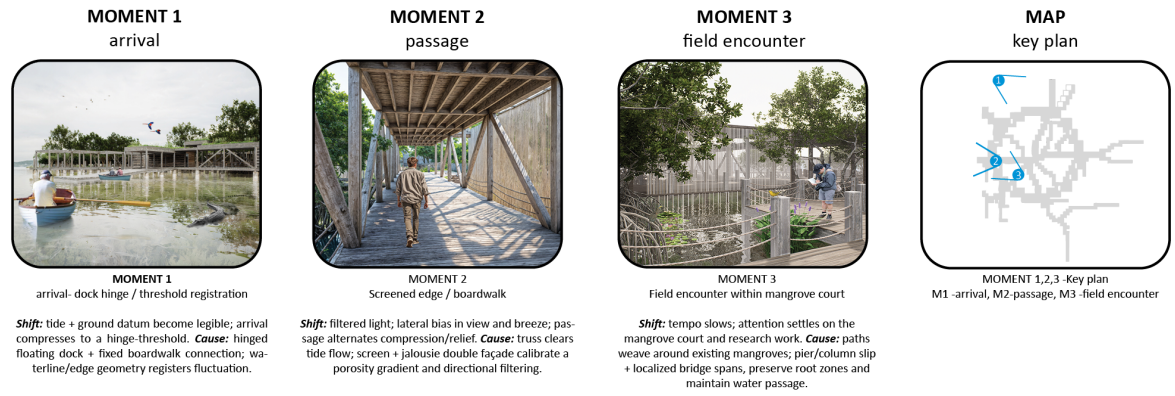


Figure 4. Phenomenology sequence plate (three moments + assembly causality). (Images: Armaan Dixon (ARCH 5656), Prairie View A&M University, Fall 2025. Figure compiled by the author).

Figure 5 juxtaposes pre- and post-revision states across book iterations (assembled and exploded axonometries, models at 1/4" scale), demonstrating how project rules govern iterative refinement. These revisions illustrate dialectical resolution: contradictions between imposed regularity and morphological principles are confronted and synthesized, yielding variations that honor site flux without breaking the module.

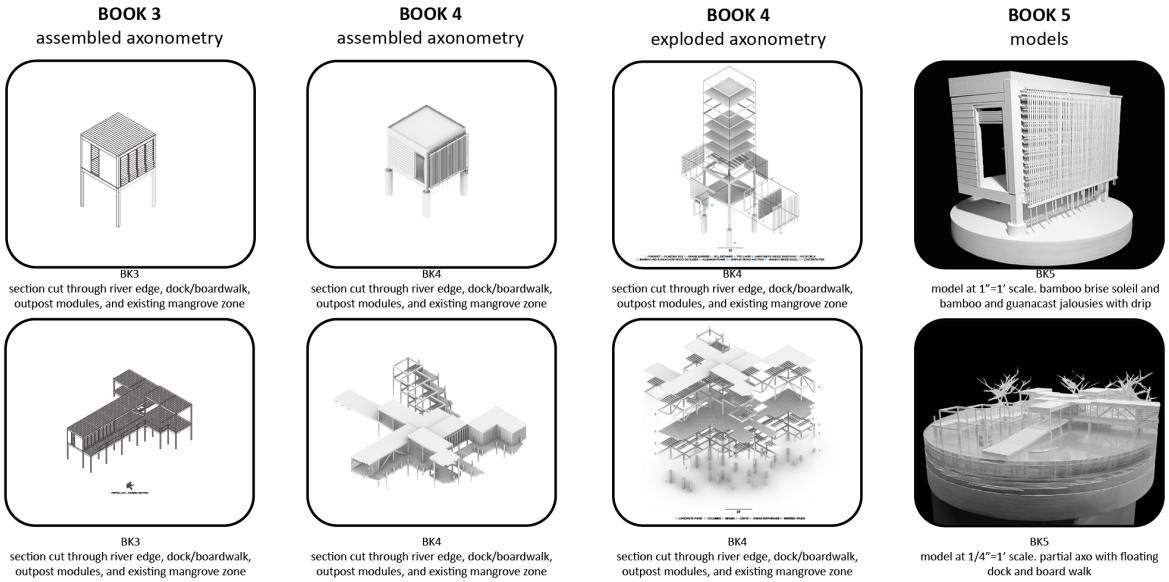


Figure 5. Pre- and post-revision states showing revision governed by project rules (Images: Armaan Dixon (ARCH 5656), Prairie View A&M University, Fall 2025. Figure compiled by the author).

The mangrove-derived studies extract porosity gradients, root lattices, and tidal interfaces as behavioral logics, translated into elevated grids, layered screens, and adaptive thresholds—avoiding biomimetic copying while responding to site flux (weather, ground, light). This case exemplifies how the framework operationalizes philosophical mediation in practice.

DISCUSSION

The framework sustains accountable expansion while preserving authority. Ontology treats AI outputs as verifiable hypotheses.[11] Taxonomy enforces evidence-first inference, converting morphological relations into testable principles. Translation anchors governance in parti rules and cross-drawing coherence.[12] Phenomenology renders atmosphere evidentiary through located assemblies and causal ties.[13] Drawing on Merleau-Ponty's embodied perception and Böhme's atmospheres, the stage treats drawing not as illustration but as performative inscription—where line, section, and assembly actively disclose experiential causality rather than describe it.[14]

Cohort performance (Fall 2025, n=13 projects) provides empirical grounding. Scoring followed a standardized rubric with inter-rater calibration between faculty (two independent reviews per submission, reconciled via discussion; discrepancies <10% on average). Ontology achieved the highest mean (9.44/10, 94.4%), confirming effective entity/constraint definition with logged verification. Taxonomy followed (17.83/20, 89.2%), affirming disciplined principle extraction. Translation remained robust (9.18/10, 91.8%). Phenomenology lagged (7.44/10, 74.4%), revealing difficulties in explicitly embedding causal experiential evidence rather than descriptive notes.

These patterns affirm staged constraints: early stages leverage AI expansively, later stages demand stricter faculty arbitration. Lower phenomenology scores highlight the need for iterative checkpoints and tighter AI-flagged prompts aligned to rubric criteria.

This philosophically mediated, constraint-driven approach contrasts with other documented AI-studio experiments. Prompt-engineering protocols prioritize rapid ideation through text-to-image models, yet often yield superficial outputs absent systematic verification or traceability to morphological evidence.[15] Conversational co-design frameworks position AI as an integrative partner across phases, emphasizing dialogue but typically lacking explicit epistemological governance to prevent homogenization.[16],[17] AI literacy initiatives stress bias awareness, provenance tracking, and prompt refinement, aligning with our verification logs but extending less rigorously to morphological-to-architectural translation.[18] The present framework thus contributes a distinctive layer—Hegelian dialectics operationalized through staged constraints—that bridges expansive AI exploration with traceable rigor, proving effective in resource-limited HBCU contexts where equitable access must not compromise cultural agency.

The cohort trends and verification challenges—particularly the lower scores in locating experiential causality—underscore what is truly at stake. Situated within Monteverde's cloud forest—a volatile environment where unbound modernist aspirations, such as those embodied in Mies van der Rohe's Villa Tugendhat, encounter radical contextual difference—the projects confront uniformity imposed by the client's mandate: a preconfigured module of heavy timber beams, columns, joists, and floorboards. The module's regularity exerts invisible pressure; its strict repetition risks erasure of site-specific voice.

How does one escape this imposition? Perhaps John Cage moves us forward: "Let randomness recalibrate our understanding of harmony".[17] Or Jimi Hendrix, unleashing a complete attack on the senses in *Machine Gun* (1970).[18] If a sequence of notes can emerge unexpectedly, then what of space, beam, and joist? The question is not breaking the module but intervening with unpredictability—orchestrating chance to liberate gridlocked logic.

In the cloud forest, nothing is absolute: weather refuses constancy, ground shifts, branches interrupt light. The projects find voice through misalignments, slow transformations, and movement through subversion. Gilles Deleuze reminds us that repetition, far from erasing difference, generates singularity and variation.[19] A thousand leaves repeat, yet each differs. Repetition is never final; within its rhythm lies possibility. The timber module becomes a platform—not a limit—when embraced as provocation. A column doubles back, a joint forgets perfect fit, a void opens unexpectedly. The 13 projects stand not as monuments to rigidity, but as reminders that repetition is an opportunity for reinvention. Nothing—not a beam, not a joint, not even the module—is static once it meets the forest floor, the clouds, the light. This emphasis on atmosphere and embodied perception is consistent with Böhme's account of atmospheres and Merleau-Ponty's phenomenology of perception and vision as bodily thought.[20],[21],[22]

Far from ornamental, these reflections return us to the framework's core wager: that philosophical mediation—through ontology's verifiable claims, taxonomy's evidence-first inference, translation's rule-bound assemblies, and phenomenology's located experiential proof—enables design to assimilate rather than imitate, to become rather than merely represent. In this way, AI serves not as author but as catalyst within a dialectical process that honors cultural agency and site contingency.

Figure 6 shows strong cohort alignment across the first three stages: BK1 (Ontology) averages 9.44/10 (94.4%), BK2 (Taxonomy) 17.83/20 (89.2%), and BK3 (Translation) 9.18/10 (91.8%). Students can set a governing claim, organize it into legible categories, and translate that logic into drawings with consistent intent. The deviation is BK4B (Verification/Variation), dropping to 7.44/10 (74.4%). Here phenomenological statements must become causal and testable—locating an experience in a specific assembly or spatial condition and demonstrating it through sectioned evidence and comparative variation. This gap guides critique and AI checks: each claim must name its trigger (light, thickness, threshold) and the drawing location that proves it in section.

Metric (Fall 2025 cohort)	Max	Mean	Mean (%)
BK1 (Ontology)	10	9.44	94.4%
BK2 (Taxonomy)	20	17.83	89.2%
BK3 (Translation)	10	9.18	91.8%
BK4B (Verification/Variation)	10	7.44	74.4%

Figure 6. Cohort snapshot (means only; no individual ranking). Data source: studio scoring summary

The rubric in Figure 7, immediately following the cohort snapshot in Figure 6, provides the precise evidentiary framework against which these performance outcomes were assessed, ensuring that phenomenological intent is demonstrated through located, causally explicit assemblies rather than descriptive notes alone.

Criterion	Evidence to show (must appear in sheet set)	Sample notes (Mangrove)
Sequence clarity	Locate three moments on section/key plan; label path logic; 1–2 causal notes per moment	3 — D1–D3 located; path legible. One moment needs stronger causal note.
Threshold legibility	Show 2–3 thresholds in section; identify changes (light, air, wet/dry, enclosure)	4 — Dock hinge + boardwalk transition shown; tidal movement registers at entry.
Atmospheric intent	Tie atmosphere to assemblies (screens, undercroft, overhangs, apertures)	4 — Bamboo screen filters light; undercroft ventilation supports porosity gradient.
Assembly causality	For each moment, identify 1 assembly condition producing experience	3 — Causes identified; add explicit section callout tying bamboo screen to assembly thickness.
Coherence across drawings	Mapping between morphology principles and section callouts (3–5 minimum)	4 — Section callouts map back to A1–A3 principles; translation evidence-first.
Orientation + tempo	Indicate openness/enclosure bias; locate pause points; describe tempo shift	3 — Openness bias clear at D2; tempo slows at D3. Add pause-point marker.

Score legend: 1 = absent, 2 = partial, 3 = complete, 4 = exemplary (scores are for demonstration only).

Figure 7. Phenomenology verification rubric used across the cohort; sample notes shown for the mangrove project to demonstrate how evidence is located and scored

This empirical profile grounds the framework's mediation layers and confirms its capacity to foster accountable, philosophically rigorous design inquiry.

CONCLUSION

AI can strengthen architectural pedagogy when treated as a bounded epistemic participant rather than a substitute author. Ontology, taxonomy, and phenomenology operate as mediation layers that preserve rigor and traceability: what can be claimed, how morphological evidence becomes inferable

principles, how principle becomes assembly, and how experience becomes evidence. Governed through a triadic consultancy and arbitrated by the parti (the controlling idea that returns project governance to concepts rather than ownership or tool outputs), the method supports a shift from appearance-copying toward assimilation—design as inquiry rather than output. Future iterations could extend this framework to undergraduate studios or interdisciplinary fields, enhancing AI's role in equitable design education.

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AMPS PROCEEDINGS SERIES 47 v1

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19-21 November, 2025

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