MAKING DESIGN

By

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A thesis submitted to the

School of Graduate Studies
Rutgers, The State University of New Jersey

In partial fulfillment of the requirements

For the degree of

Master of Landscape Architecture
Graduate Program in Landscape Architecture

Written under the direction of

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New Brunswick, New Jersey

May 2021
University landscape architecture program studios can harbor unethical studio environments. Current accreditation standards and antiquated views on the value of models in representation can lead to a focus on the technical requirements of curriculum, rather than the effect of studio culture on a student’s design process. Models can play a unique role in the design process yet are often used simply as representational tools. In this thesis, I argue for the benefits of foregrounding a making-based approach in landscape architecture pedagogy. This can allow for new forms of creativity, design, and visualization to emerge in the classroom and professional studio environment. The goal of this thesis is to offer an approach to creating a studio culture that enables students to bring their own skills, histories, cultures, and interests into the design studio.

A making-based approach can allow students to achieve the technical goals set forth in formal university accreditation processes, while also encouraging compassion in the design process for students. This proposal is supported by existing scholarly research, professional design approaches, student and educator interviews, personal making reflections, and making experiments conducted in studio classes. Results from collective student feedback illustrate that modeling and making bring to light many
lessons for design students that allow for a more personalized, comfortable, and ethical studio environment that still achieves class objectives.

By providing additional resources for encouraging a making-based approach, students and educators can start to change the standard of studio culture, which in turn may inform professional practice as well. The Making Design website (http://makingdesign.xyz/) and Creativity Zine were created through a making-based process, for use by educators and students. These resources serve as catalysts for creativity. As the making-based approach emphasizes process over product, resources and ideas surrounding the making-based approach will continue to develop and adapt to new environments.
Dedication and Acknowledgements

Dedicated to the past, present, and future students who forever carry the memory and essence of their studio: keep yourself present in your process.

I would like to thank my advisor, Anita Bakshi, for your ongoing encouragement, guidance, and passion. Your commitment to an engaging and inclusive studio environment through making is a motivating force. Thank you to my thesis committee, Vincent Javet, Anette Freytag, and Daniel Hayden for your rich expertise, support, and feedback.

Thanks to the faculty and students of the Rutgers Department of Landscape Architecture for your open-mindedness with exercises and interviews as well as Jeanine Oleson and the students at Mason Gross School of the Arts for your valuable perspective and seminar space. Thank you to my friends and fellow makers at the Rutgers Makerspace for teaching me what “making” is all about.

Thanks to Megan Lotts, James Melsom, and Ilmar Hurkxkens among many more intellectuals, makers, and innovators for enriching discussion and feedback on my work.

I am grateful to my family and friends who have listened, stood by, and helped me get through this thesis (in a pandemic nonetheless). Despite not having a physical studio space, a supportive atmosphere persisted.
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Introduction

This thesis project focuses on the benefits of introducing a making-based approach to landscape architecture design studio teaching. This can allow for new forms of creativity, design, and visualization to emerge in the field of landscape architecture.

An overview of the benefits of a model or making-based approach is presented based on my background and expertise in making and modeling, and recent personal experience in landscape architecture education.

A making-based approach primarily uses modeling and making as exploration, design, and representation methods in the design process. Such an approach places “making” central to all phases of the design process - including conceptual, schematic, design development, and construction stages. The exploration and testing of this approach presented here is supported with a review of existing scholarship around the topic, interviews with students, and experimentation with exercises in studio classes. From this investigation, and my own personal making explorations, I have been able to draw out important lessons and concepts vital to a making-based approach.

Making and modeling have historically been used in landscape architecture pedagogy, but the extent to which they are utilized is limited.¹ In an exploration of the common pedagogical structure of undergraduate and graduate landscape architectural programs, this thesis examines the reasons as to why current educational settings may be limiting modeling and making methods. This study argues for embracing a making-based approach in landscape architecture curriculum using scholarly research regarding design process methods and visualization techniques alongside anecdotal information from student interviews. Supporting this with exercises conducted in undergraduate

design studio classrooms at Rutgers University and with my own personal experiences, this thesis makes the claim that a physical modeling approach offers many benefits to students in design studio. A making-based approach offers benefits similar to an immersive experience of the site and can support an iterative design process. Students are encouraged to explore their own histories, interests, and cultures, bringing varied perspectives to the studio space. I argue that with this approach, time for play and exploration can be interwoven into design studio pedagogy.

This thesis is organized into three chapters following this introduction. First is “A Making-Based Approach.” This chapter gives background to the current state of landscape architecture education and introduces the making-based approach. Existing ideas of the model are discussed, as it is commonly seen as expensive and purely representational, currently creating an obstacle for students in the design studio. The making-based approach is proposed as a pedagogical method that supports a productive design process and an inclusive studio environment.

Chapter two is “Making in Design - History and Student Experiences,” which presents a summary of my analysis of several major trends and approaches related to the role of the model in the design process. Examples of different uses of models are detailed in a variety of disciplines and recent visualization theories relating to landscape architectural design representation. This chapter contains my findings and summaries from students, through anonymous interviews. This chapter gives a base impression of common theories in making-based hybridized approaches, and student attitudes towards modeling and making.

The next chapter is “Making-Based Studies in the Design Studio.” In this chapter, a making-based approach in design studio classes is tested at Rutgers University Department of Landscape Architecture. Working in tandem with instructors of the Sophomore Introduction to Environmental Design Studio and the Senior Advanced
Landscape Architecture Housing and Open Space Studio, five studies were devised to have multiple students test out specific model-based exercises as a part of their overall studio experience. Lessons drawn from this create recommendations for how to effectively integrate a making-based approach in landscape architectural curriculum.

Feedback from students, as well as lessons from my personal makings, guide the proposed resources for a model-based approach. These are written about in the fourth chapter: “Recommendations for a Making-Based Curriculum.” The proposed resources, a Creativity Zine and the Making Design website for landscape architecture educators and students, are a process in themselves. In them, themes and suggestions to implement a making-based approach into existing landscape architectural pedagogical structure are offered.

In between every chapter are interludes consisting of reflection essays on my personal making. The personal explorations are designed to highlight different aspects of essential concepts in a model approach, examining the effectiveness or unnecessary parts of a given project. Important skills and lessons include learning how to “waste” time creatively, playing with unexpected materials together, exploring building techniques rather than building objects, logistical production skills, and creating an individualized model-based approach that is most effective for the student participating. The explorations will be displayed in a digital gallery on the Making Design website and act as physical representations of the lessons realized from the exploration process.
Chapter 1: A Making-Based Approach

My interest in making came from my own experiences and struggles as a landscape architecture student and working as a technician at the Rutgers Makerspace for the past three years. I found myself often asking:

- How does the use of multidimensional techniques, tools, machinery, and material impact the design process; and more specifically, in terms of students' perception of the site?
- How could the creation of new modeling procedures, or a making-based approach impact student learning?
- How might this enable students to bring their own personal skills and interpretations to a design problem to broaden and diversify the kinds of designs and representations that are created in design studio classes?
- Could a making-based approach allow students to access more creative or personal responses to a design problem?
- What are the alternatives to a means-to-an-end representational tool strictly for communicating student-to-educator or designer-to-client?

Modeling can be more strongly integrated into the student design process by providing students and instructors with resources and strategies for exploring making-based approaches in their courses and design projects. To demonstrate this, this thesis worked with undergraduate students and instructors in several design studio courses in landscape architecture at Rutgers University. A series of exercises and associated questions asked students to reflect on this process. In this way, this thesis examines if

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and how a making-based approach might affect their design process. By analyzing students’ resulting models and written reflections, conclusions about how making projects allowed students to access new pathways for creative work are drawn.

From Academia to Professional Practice

Landscape Architecture is a vast field with a diversity of project types and approaches taken on by private practices and university programs alike. Innovation in landscape architecture is seemingly limited by the lack of integration between education, practice, theory, and research. Exploration by individual practitioners and educators in their creative processes is often not transferred back into the norms of professional practice and design education. Research and theory regarding methods and techniques have trouble finding their way into education and practice when faced with logistical factors, such as time, cost, and the reluctance to change a system that appears to be working.

A logical place to enhance this integration and to achieve more effective communication between education and practice is in landscape architecture pedagogy. An alternative approach to traditional landscape architectural pedagogy may aid in this integration and can address this fracture in communication between education and professional practice.

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4 Carl Steinitz, “A Framework for Theory Applicable to the Education of Landscape Architects (and Other Environmental Design Professionals),” Landscape Journal 9, no. 2 (Fall 1990): 136.
Licensure as a landscape architect requires an education at an accredited institution to learn techniques, tools, theories, and processes that can inform the design process. Although the LAAB (Landscape Architectural Accreditation Board) accreditation process maintains specific guidelines for university curriculum, decisions made by departments and instructors on studio topics, final deliverables, and methodologies have a large impact on the student. The training of landscape architecture students through studios is somewhat dependent on the interests, publications, ideologies, unconscious biases, and instructional methods of the educator. Schools in turn can create “stylized” graduates - each student of a particular school may have a recognizable emphasis on certain techniques, tools, theories, and processes than others. This feeds into the cycle of “stylized” offices and branded theorists in the professional world, which in turn educate students. Instead of a “stylized” education, a better option for students is a curriculum that emphasizes techniques, tools, theories, and process. This structure, grounded in a making-based approach, would allow students to take the time to create and develop their own processes and techniques. Interventions in pedagogy have the most power to affect change in the structures of the field.

The approach advocated for here - based on my own experiences as an undergraduate and graduate student in landscape architecture and as a team member in a university makerspace - places making and modeling central to all phases of the

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9 Steinitz, “A Framework for Theory Applicable to the Education of Landscape Architects (and Other Environmental Design Professionals),” 195.
design process. Brown\textsuperscript{11}, Frangos\textsuperscript{12}, and Freytag\textsuperscript{13} have argued that design thinking and visualization methods can be analyzed and altered to open up to a making-based approach, emphasizing the goal of teaching students creative ways to approach design. The idea of a making-based approach focuses on a wide variety of techniques, at different levels, mediums, and processes, that accentuate thinking, creating, designing, and visualizing in a three-dimensional way. This approach encourages students to incorporate multiple methods within the design process, thereby allowing them to understand the material world in a more complete way.\textsuperscript{14}

In the long run, additional benefits would result from implementing this approach in design education and would slowly integrate into the professional practice over time, bringing energy to theoretical approaches to innovative design thinking. A number of relationships that are important to the process of designing and building landscape architecture projects require effective communication. These include:

- Landscape architect and site: the landscape architect must interpret the site - understand, analyze, and get to know the site - and find ways to rethink and redesign the terrain.\textsuperscript{15}

\textsuperscript{13} Anette Freytag, “Back to Form: Landscape Architecture and Representation in Europe after the Sixties,” in Composite Landscapes: Photomontage and Landscape Architecture (Hatje Cantz, 2015), 93.
\textsuperscript{14} Hermie Delport and Jolanda De Villiers Morkel, “The Importance of Physically Built Working Models in Design Teaching of Undergraduate Architectural Students” (ConnectED 2010 – 2nd International Conference on Design Education, Department of Architectural Technology, Faculty of Informatics and Design, Cape Peninsula University of Technology, Cape Town, Western Cape, 8000, South Africa: International Council of Design, 2010), 1.
\textsuperscript{15} Christophe Girot, “A Return to Terrain,” in Field Instruments of Design (gta Verlag / eth Zürich, 2015), 14.
• Landscape architect and landscape architect: designers must communicate to each other, in a language that they are trained in (plan, section, detail) to communicate interpretations, connections, and design of the site.16

• Landscape architect and contractor: the landscape architect must communicate to the builder, maker or fabricator through plan, section, detail, their design of the site.17

• Landscape architect and client: the landscape architect may need to communicate through different means other than plan, section, detail to represent design ideas such as sketches, perspectives, or models.18

• Landscape architecture educator and student: the educator needs to teach the student ways to communicate with the educator, other landscape architects, contractors, and clients. Educators must teach the student strategies for all the above listed relationships.19

• Landscape architect and self: the landscape architect needs to become more aware of their own ideologies, needs, interests, and biases to better understand their own design process.20

The design and visualization methods and themes explored in this thesis aim to showcase different perspectives for translating information and design intent between all the parties. These methods aid design communication across multiple parties in the long

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19 Ibid, 197.
20 Ibid, 204.
run. Emphasizing the role of modeling and making within the landscape architecture education sequence can lead to achieving greater communication between education and practice; enhance the creative process; and lead to a more holistic design thinking experience for the field of landscape architecture.

Modeling and Making in Academia

Modeling and making are broad terms for design and visualization methods that efficiently aid landscape architects as a design exploration tool, but also act as a means of exploring identity in the studio. Self-reflection, personal interests, histories, and collaboration come into play with making and modeling. On a physical level, these techniques work on multiple scales, with multiple materials, tools, software, and machinery. They work as creative exploration tools for tectonic problem-solving, in-depth informational representation, and serve to hybridize various techniques and tools. These tools may include but are not limited to playing with sand, clay, and other various materials by hand; 3D scanning objects and topography of different scales through photogrammetry and point cloud scanning; high-powered material manipulation through CNC milling and laser machines; and photo manipulation and drawing through Rhinoceros (Rhino), Photoshop, among other artistic endeavors.

Shifting to a model-based strategy can allow designers to connect with the site more deeply. These approaches allow landscape architects to design by doing; allowing for thinking in three-dimensional space rather in a two-dimensional plan view. This further enables more effective communication and an exploration of individual

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creativity and style through physical manipulation. Making and modeling emphasize the versatility of the method and its potential to offer more experiential and in-depth understanding due to opportunities for enhanced three-dimensional thinking.

In landscape architectural education and in the professional realm, models can be used for interpreting or analyzing a site or project; understanding a general concept or skill; designing a site iteratively; interpreting and analyzing the design; and for visualizing and representing the design in a multitude of ways. These roles are all forms of communication and translation. Any of these modes can be hybridized to create more modes, enhancing that translative ability in different ways. According to Suzanne Mathew, associate professor at Rhode Island School of Design, “[h]ybrid drawings allow for the coupling, or layering of multiple views and methods, as well as the juxtaposition of differing or even conflicting ideas.” This hybridization is crucial in the making process.

The way that students interact with modeling is up to the educator and the techniques the educator prefers to emphasize within their class. Thus, instruction is limited to a knowledge base that is within a particular department’s faculty. There is room for growth in modeling techniques throughout the entire design studio course process, rather than serving only as a final representational tool at the end of the semester. Limiting the model in this way is indicative of the overarching problems within current instructional norms. The existing conditions of the field have made the model out

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to be a waste of time and money, an obstacle in the way of typical final deliverables and design studio goals.

The typical landscape architecture program starts off with an introductory visualization course in the freshman year. This is the case at Rutgers University\textsuperscript{23}, Pennsylvania State University\textsuperscript{24}, and Clemson University\textsuperscript{25}, among others. Some students may have previous skillsets in the arts, but this is not mandatory. For many, the initial visualization class is the first time they may ever have held a stick of charcoal. For


those with little experience, there is reluctance to put a stroke on paper with such a permanent material and tool. Replacing this exercise with a more malleable material, such as clay, would provide a less intimidating exercise; the clay can be moved, melded, and rolled back up into a ball for the next exploration.\textsuperscript{26} The process can still be documented and saved, pinned up onto the wall, while allowing students to explore creativity in what may be a more comfortable way.

Alongside modeling, students could still learn other visualization techniques based on their creations. Similarly, the construction sequence starts with learning the basics of topography and contour lines - a concept that does not resonate with some students for a long time. An alternate approach to lecture or pencil and paper, is again, a clay model. This technique is typical at some schools like University of Toronto. Students in the Master of Landscape Architecture Degree at the University of Toronto\textsuperscript{27} use clay and string to explore topography, later regrading features to accommodate accessibility and drainage within their first semester of the first year.\textsuperscript{28} Through this approach, students are continually reminded that they are not just creating a two-dimensional artwork, but real, physical land. Modeling allows for a more immediate connection to the physical terrain of the site. A more advanced alternative for students in digitally analyzing terrain without having digital model experience is through a photogrammetric live-scanning sandbox.\textsuperscript{29} Providing options for students to explore new concepts, both

\begin{itemize}
  \item LAN1045H: Site Engineering and Ecology taught by Shadi Ramos in 2015 at the University of Toronto John H. Daniels Faculty of Architecture, Landscape, and Design; “Master of Landscape Architecture,” University of Toronto John H. Daniels Faculty of Architecture, Landscape, and Design, University of Toronto, accessed March 25, 2021, https://www.daniels.utoronto.ca/programs/graduate/master-landscape-architecture-professional.
  \item Vincent Javet (Instructor at Rutgers University Department of Landscape Architecture) in discussion with the author, March 25, 2021.
  \item Ilmar Hurkxkens and Georg Munkel, “Speculative Precision: Combining Haptic Terrain Modelling with Real-Time Digital Analysis for Landscape Design,” in \textit{Peer Reviewed Proceedings of Digital Landscape Architecture 2014 at ETH Zurich} (Digital Landscape Architecture 2014, Zurich, Switzerland, 2014); brought to Rutgers University Department of Landscape Architecture
\end{itemize}
technical and artistic, leads to more efficiency and comfort in the learning process.\textsuperscript{30} There are many possibilities of what a making-based structure may look like, using the existing common pedagogical structure for landscape architecture programs.

**Means-to-an-End Representational Tools**

Several constraints determine what deliverables students are able to produce by the end of the semester for design studio. These include individual time constraints as well as the list of deliverables provided by the studio instructor. Such long lists can be overwhelming. Student interviews revealed there is reluctance to try out other kinds of representation that may be more suited to design explorations because of these constraints. This limits alternate creative responses that may be more specific to the design intent. Leaving more open-ended deliverables can lead to more creative outcomes that allow for different methods of design, more creative designs, and, for some, a more effective education.

While deliverable lists may include a 3D printed model, or laser cut chipboard model, these end products may only highlight one aspect of the design and are seemingly included to create a cohesive studio aesthetic to the projects. Several students\textsuperscript{31} recognize this as a means-to-an-end representational tool, meant strictly for communicating student-to-educator or designer-to-client. Relying on this approach limits diversity and creativity in the process of design itself. At advanced institutions across the world, like ETH Zurich, there is a move to structure pedagogy in a sequence to expose

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\textsuperscript{31} Anonymous Students, in discussion with the Author, May 2020.
students to different modes of design technique. There is value in focusing on the sequencing of pedagogy over the individual tools themselves to integrate technique training applicable to the design process.\textsuperscript{32}

Representation strategies should be about communicating ideas, but the form in which it is done ultimately affects the design itself, according to Dr. Anette Freytag, Professor at Rutgers University and Dr. Nadia Amoroso, Professor at University of Guelph.\textsuperscript{33} When a professor gives a deliverable list at the beginning of the semester, detailing the design of the final presentation, most students immediately start moving towards creating an idea that is represented well by those deliverables. For example, if a professor requires a set of diagrams, plan, and multiple sections; a graphic drawing style, albeit analog or digital, must be developed for these deliverables. Thus, the design choices themselves are made to fit this form of representation. If the professor asks for a chipboard laser cut model, students are more inclined to make a topographically dramatic design. If a 3D printed model is desired, students may have to think logistically about how their design can be supported by different types of 3D printers and their associated materials. In this way, a final deliverables list limits the creative potential of the student, as they are always thinking about the design as represented in the final presentation. Alternatively, a making-based approach would allow a student to explore more design options, dictated by materials and methods that are individualized, rather than be restricted by studio standards.

\textsuperscript{32} James Melsom (Lecturer at University of Technology Sydney) in discussion with the author, January 27, 2021.

\textsuperscript{33} Cooper, "Review of Representing Landscapes: Hybrid by Nadia Amoroso;" Freytag, "Back to Form: Landscape Architecture and Representation in Europe after the Sixties," 95.
Privilege and Access in Landscape Architecture Education

A model and making-based approach in landscape architecture programs raises issues of access and privilege in schools. Who is invited to model and make? Who has the resources to do so? Whether physical or digital, the idea of modeling can seem intimidating. A lack of exposure to various methods, and the perception that crafting and making is always associated with fine artistic handwork can lead to reluctance to engage with these methods. Materials can also be limited by financial means, as not all students are able to spend money on a multitude of materials to make models. The rising prices of design education are already too steep for many students to handle, with many needing to work multiple jobs just to stay in school. According to Nicholas Korody of Archinect, “on average, an architecture student pays $1,117 annually on materials. Afterwards, many of these models are thrown away after crits, or in some cases, are literally torn apart by professors.” 34

While students are now expected to pay for their computer, software, and model materials, there are also differences in access on the institutional level. Ilmar Hurxkxkens of ETH Zurich and James Melsom, lecturer at University of Technology Sydney, note the criticality of constant making and documentation. 35 These scholars consider not just the decision to make, but what to make, and which tools and materials to use in the process. 36 Fortunately, at ETH Zurich, the possibilities of using robotics, point cloud scanning, and other advanced visualization techniques are possible. While former

36 Ilmar Hurxkxkens (Lecturer at ETH Zurich) in discussion with the author, January 27, 2021; James Melsom (Lecturer at University of Technology Sydney) in discussion with the author, January 27, 2021.
students of ETH Zurich stress the importance of using open-source tools as much as possible, they acknowledge their exposure to advanced tools and techniques in their education that sped up and changed processes. In high-level design institutions, it is more likely that students would be able to access advanced tools and processes. However, the effect of bringing a making-based approach (with these critical factors in mind) to the general field of landscape architectural education - funded or not - is the critical question.

Vast access differences have created an exclusionary sphere in which only the privileged are able to enter architecture and related fields. Significant expenses and time commitments take time away from the critical process of making. Alternate solutions exist, such as making models out of found materials, or to having “lost and found” or “unused materials” sections within a program as a free access spot to find crafting materials and tools. Students are also struggling to find the space to model and make. While some schools have fabrication labs within their building, these can be limited, understaffed or unstaffed, unsafe, or just intimidating. Other workspaces on campuses, such as Makerspaces, may be too far away, inaccessible without transportation, or difficult to find. At Rutgers, the Makerspace is a ten-minute drive away from the landscape architecture building. Alternatively, students must wait for and take a thirty-minute bus ride to get there. Students need spaces nearby with the adequate tools (materials, software, machinery) to create their designs and to experiment. The existing structure of access and privilege in many schools is not conducive to a making-based approach.

37 Ilmar Hurkxkens (Lecturer at ETH Zurich) in Discussion with the Author, January 27, 2021; James Melsom (Lecturer at University of Technology Sydney) in Discussion with the Author, January 27, 2021.
My Proposal for a Making-Based Approach

This proposed making-based approach focuses on making as a process that is integrated into the iterative process of design. The approach asks students to use three-dimensional making techniques from the beginning of the design project and can be used from the very beginning of the semester, even for interpreting and analyzing the site through model. The process might take the form of a materials analysis model that uses some sort of material from the site or may even involve simply shaping clay to interpret the site visit experience. Students could take a 3D scan of the site and then fabricate it with a computer numerical controlled router model of the topography. Such processes serve to build intimate knowledge of the site and the land and can be a meaningful counterpart to other data and statistics that are researched during the site inventory and analysis phase. A making-based approach integrates making throughout the design process, creating a holistic, or more interconnected and iterative process.

Conceptual models may consist of modeling a scalable modular object, network, or technique that informs the rest of the design process. Site models encourage students to make solid decisions by seeing the site in a mode that is closer to the reality of physical experience than the orthographic projection modes of plan and section. They must then accurately represent the site itself, ultimately creating more cohesive details. Context models allow students to easily explore the relationship between site and surrounding area, allowing more freeform activity than drawing.\(^{39}\) Thus, one benefit of a making-based approach is a greater understanding of all moving parts of a particular site or design from the students’ perspective.

\(^{39}\) Girot, “A Return to Terrain,” 19;
An iterative approach is enabled with modeling, as students can model by hand, scan, move into 3D modeling programs, like Rhino, manipulate with mouse, print out, manipulate back by hand, and, over time, use these tools to communicate the design. Sketching may not even be a part of this process at first. Although drawings can be derived from this process, designing in the third dimension allows someone to constantly design in perspective as a first step, becoming intimate with the site and design. In “Land-Movement Thinking,” landscape architect Kathryn Gustafson states, “I learned many lessons from [the first large-scale earthmoving experiment that I did], the first being the preeminent role that the small clay model played throughout the design and construction process.” 40

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Kathryn Gustafson’s process of clay modeling as an exploratory tool, representational piece, and workable construction document eloquently displays the model as central to the iterative process of design. While her process has changed with the implementation of 3D scanning and digital modeling techniques, the clay model remains central to her process.\textsuperscript{41} Taking inspiration from Isamu Noguchi and Igor Mitoraj, Gustafson starts to form topography in clay, digitally scanning and working on the same model in digital modeling software, bringing the project to life.\textsuperscript{42} Her clay models are also captivating pieces, communicating the importance of topographical manipulation in the design.

Gustafson’s process illustrates a non-hierarchical use of digital modeling and physical modeling. While each has pros and cons, this shows how each technique can work in tandem throughout the design process. In the case of Gen-Z students entering landscape architectural programs, digital model techniques have become the default design tool for many – students tend to gravitate towards what they feel most comfortable with.\textsuperscript{43} However, both digital and analog methods are necessary to enhance the design experience.\textsuperscript{44} Whether the student starts with digital or physical modeling is dependent upon their prior expertise and comfort level, but the process of using both hands and mouse is essential to get a full picture of the site and design.

Students who have no experience with digital modeling may be more inclined to start with physical modeling. These models can then be translated to a digital format and applied in different circumstances and parameters. It is important encourage a hybrid process of working with hand modeling techniques, which can then be transferred to the

\textsuperscript{41} Gustafson, “Land Movement,” 158.
\textsuperscript{42} Ibid, 158.
\textsuperscript{43} Delport and De Villiers Morkel, “The Importance of Physically Built Working Models in Design Teaching of Undergraduate Architectural Students,” 1.
\textsuperscript{44} Ibid, 1.
computer to be manipulated through digital techniques, written scripts, and apps. The model can then be digitally fabricated, further manipulated physically, and then entered back into digital modeling. 3D modelling software has functions that can generate standard orthographic projection drawings, in plan, elevation, and section, from the digital model. These tools automate the process into an easily readable communication tool between designers and builders. Thus digital modeling can be used iteratively to ultimately achieve effective and efficient modeling-based experiences.

At SITU NYC - a firm focusing on design, research, and in-house fabrication - designers start with thinking about optimal construction approaches for the design at hand. The artist’s vision, technical tools available, and multidisciplinary conversation lead to design and material studies. The physical model studies are then translated into a 3D model, a critical tool for fabricating the product and managing the construction process – resulting in the fabricated installation. SITU’s process illustrates a formulaic approach to design that keeps the model central to process, while allowing for the flexibility of an iterative method. Much of their work results in a fabricated object as the final project, meaning that SITU’s designers must be more concerned with the tectonics of the objects they create. If students had to operate in a similar manner, working towards the fabrication of a physical object as an end goal, this would impact the process and force them to engage with the work in different ways.

47 Ibid.
Analysis and design procedures, like those at SITU NYC, can ultimately become representational tools at the end of the project, while at the same time creating intriguing pathways of thought and connection to the site. This can serve to aid communication between the client, educator, and/or peers at the “final presentation.” Therefore, the design process and final representation of the design are always connected and moving back and forth.\(^48\) While this thesis focuses mainly on model as process, it is important to note that process and representation are connected, and modeling contributes to that relationship.

The shift to a making-based approach can enable students to be creative and “waste time” – or rather, “forge time.” Wasting time should be expected, as it encourages exploration and solidification of ideas through hand and digital modeling or fabrication. Allowing time for exploration within the design process allows the student to be relaxed, to consider different options and perspectives, and to produce a quality, original product. Rather than trying to jump into drawing a plan and section, modeling first leads to solid conception of an idea. Students can then move between drawing and modeling in the final stages of communication. The logistics of the typical design studio or professional office, where long hours are spent pushing out drawings or fulfilling deliverable lists, may not support this idea. A making-based approach can allow for the design, documentation, and final deliverables to work together to create pin-up components and representational pieces that are ultimately more effective and helpful to the student.

Design exploration through making and modeling also leads to students being able to incorporate their own pre-existing skills and techniques into their work – an act of stretching out the hands of landscape architecture to interdisciplinary interaction and combining a student’s comfort within design for a smoother transition into the design process. A modeling-based approach means that strengths can be used and built upon, while other skills may be learned simultaneously.

Before I entered college, I was an avid knitter and practiced the skill to a high level of expertise before realizing I could apply it to the design process. Knitting is not a technique that would be learned in a landscape architecture program, but incorporating the technique, for those who already have this skill, into model-making can be effective and allows for exploration in variation in yarn weight, material, stitch choice, tension, and

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amount, among many other factors. This type of network-based modeling method opens a new avenue for creativity and thinking in the design process concerning unexpected materials and out-of-the-box methods.\textsuperscript{50} This strengthens the flow of creativity in the design process from start to finish. The making-based approach allows students to bring outside skills and expertise into the field of landscape architecture, potentially allowing for creative responses that may not be enabled through traditional techniques or materials. The approach opens accessible avenues for students to be creative by using skills that they bring to the academy. This creates benefits for other students and for instructors by introducing unexpected inputs and learning opportunities into the design studio.

It is possible that using a physical-first, model-based design method throughout the education sequence can introduce students to new techniques while also making connections between process, visualization, realization, and logistics involved in a design. In this thesis, feedback from students in the form of interviews, as well as exercises put into practice in different undergraduate studio courses at the Rutgers landscape architecture program explore the effect a model-based approach on the learning and design process. In addition, my own personal making and modeling explorations and artwork highlight lessons learned through my own explorative projects and procedures.

Interlude I: Chain Box

I believe the best way to test an approach is not only through research and narrative, but physical making and testing – after all, what does a making-based approach even entail? My first personal making experiment stemmed from a need to begin working with my hands and start somewhere with the physical component of this project. The process of this making experiment continued to guide decisions for my making experiments down the road in terms of methods for pulling lessons and observations from the process of physical making.

Chain box did not start as a vision, or even with that name – it started with some yellow plastic chain from a hardware store and old acrylic yarn buried in my “to-knit-eventually” pile. I picked the materials based purely on aesthetics and availability – I like the colors, and I like the “chunkiness” of the individual objects. I also like that both objects are just plastic, in different forms – the chain being HDPE plastic, and the yarn

Figure 5: Chain box tectonic exploration through knotting. Photo by author. May 2020.
being acrylic fiber. I did not know what I was going to do with them. Perhaps the selection of material itself was part of what created such a unique object – the combination was unexpected and chosen spontaneously. Having a mess of yarn and other spare making materials allowed me to have options in what I wanted to create. However, limiting myself to two materials – both even deriving from plastic – put constraints on the work as to not overwhelm the other qualities of the making, like process and form.

My ideas typically generate when I am busy with doing something else – sitting down and thinking is typically a recipe for writer’s block. So, while working on knitting a personal project, I thought about how to connect the knitting to the chain, something that was already looped together to itself. Maybe it could create a “chain quilt” – a series of knitted squares within “chain panels,” connected by the chain itself. This could fold and become versatile, like a constructive fabric. I started with a sketch to ensure that I had enough chain to create eight 4x4 loop panels without breaking the chain. And so, I experimented with creating a chain fabric with one single piece of chain, trying a straight knit garter stitch, then a purl stitch, and a ribbed stitch. I also tried casting on the knitting directly on to the chain, and then knitting the square separately from the chain and connecting it by a series of knots. Eventually, it failed.

I did not create what was intended. What came out was a curvy snake of chain, with misshapen squares trying to keep a geometric shape, and messy, looped edge transitions of chain and yarn. Chain got squished in weird places and everything lost shape. However, this was a test piece – it allowed me to determine the techniques that would work best for a next product – a straight knit garter stitch, knotting the panels on the chain, anticipating that the chain had to be cut and chained to itself. I do not think there was any fault in this, or even maybe that it necessarily failed. Perhaps, the sketch that I had created beforehand created an image that did not exactly mirror the finished
product of this experimentation stage. I went on to tweak the process, without any
sketching. What drove this experiment was not the visualization of a final form, but the
creation of a technique or crafting strategy – methods for connecting these two typically
structureless materials and making something that has potential to make any number of
forms or structures.

I created several individual panels, working with just knitting yarn. I then went to
create the “chain skeleton,” now needing to snip the chain and fit loops back over onto
itself, creating a series of “closed chain shapes” that could be further connected to a
“chain volume”. At this point, I struggled with finding a tool that could cut through the
chain. I tried scissors, a knife, but what eventually worked was garden shears. The use
of an unanticipated tool, not necessarily associated with model-making itself, was
significant in finding a way to quickly problem-solve in the moment and recognizing that
there is no standard “toolbox” for makers or modelers.

Figure 6: Chain Box materials and tools. Photo by author. May 2020
I got my process down to connecting the knitted panels to the chain skeleton with four double knots per side, trimming the excess. The final volume was a cube in theory – 6 sides of 16x16 knit garter stitch in 4x4 plastic chain panel. It was wobbly, organic, and moveable. The box did represent itself more as a geometric shape when suspended, but only somewhat supported itself when set on a flat plane. The final materials were successfully combined to create something that revealed a structural condition, resulting from the chain connection and knotted yarn method combination.

Figure 8: Chain box suspended. Photo by author. May 2020

Figure 7: Chain box deflated. Photo by author. May 2020
Chapter 2: Making in Design - History and Student Experiences

This chapter offers a summary of investigations into several leading trends and modes of thinking related to the role of making and models in the design process. This is a vast area, and this assessment is selective. Topics pertaining to landscape architecture education and contemporary approaches regarding making and modeling are in the foreground because this thesis assesses current pedagogies and practices.

Drawn here are a few streams of research from the last several decades. First, this section explores the use of models in a variety of disciplines and techniques. Next, this chapter explains recent developments in approaches to representation that point to the importance of 3D models, both physical and digital. Finally, it gives a brief overview of the recent development in digital modeling tools and technologies.

The chapter ends with a summary of information gained from interviewing students from the Rutgers Landscape Architecture Department. This information was collected with permission from the Rutgers University Institutional Review Board and is kept anonymous to protect interviewee identity.

The Use of Models in Architectural and Landscape Architectural Design

While the model can be viewed as a final representational tool to explain ideas to clients, in other words, a means-to-an-end representational tool, many designers and scholars point to other roles for the model. The Design Committee of the Journal of

51 IRB ID: Pro2020001594
Architectural Education identifies current trends in architectural design frameworks; including material experimentation and analysis, interdisciplinary research, unmediated and mediated representational techniques, working with visualizing data, questions about technique exploration and implications, among other things.\textsuperscript{52} All of these topics - surrounding the question of the role of the model - are apparent in the recent work of several designers utilizing modeling in their professional practice.

Kathryn Gustafson, co-founder of both Gustafson Porter + Bowman (GP+B) in London and Gustafson Guthrie Nichol (GGN) in Seattle, takes inspiration from Isamu

\textsuperscript{52} Brown et al., “Design Frameworks.”
Noguchi, Dennis Oppenheim, and Igor Mitoraj in her work. Gustafson creates a relationship between art and design, viewing her clay models as “sculptures.” After creating her “first large-scale earth moving experiment” in 1986, Gustafson notes that she learned many lessons from her model, marking a shift from her prior design work. Gustafson mentions that she loves that a model cannot lie to her, and the sensory connection it offers of feeling herself in the space. Gustafson’s process, as indicated briefly in chapter one, highlights the centrality of the model to her process. Modifying the process through the years to adapt to digital needs of collaborators, Gustafson’s lessons outline a model’s further benefits as a communication and construction tool.

Contemporary uses of the model stem from ancient techniques, as represented in the exhibition Sempering—Process and Pattern in Architecture and Design, curated by Luisa Collina and Cino Zucchi. In an exploration of the role of “ancient crafts” in nineteenth-century architect Gottfried Semper’s work, this exhibit examines a resurgence of craft in design. A collection of “sempered” models display the use of craft in model-making and can “be read at multiple scales,” acting as conceptual models. Critic Naomi Frangos takes Semper’s perception of detail coming from the artisan’s hands and compares it with the use of architectural details today, especially in digital modeling techniques. Frangos ponders whether this exhibit - and Semper’s approach - are about the techniques themselves or concepts regarding the approach of the techniques. Although the visitor views a collection of beautifully handcrafted work,

54 Studio Jomo, “Kathryn Gustafson: Designs for Body, Mind & Soul.”
56 Studio Jomo, “Kathryn Gustafson: Designs for Body, Mind & Soul.”
58 Ibid.
59 Ibid.
Frangos concludes that “these form-making investigations suggest that the substance of an idea supersedes that of technique.” Semper’s work is a vehicle to reflect on ancient crafting techniques that inform modes of thinking through future design. As a result of this exhibit, an emphasis is put on the role of making techniques as concept builders.

Modeling is not strictly limited to spatial design practices - it appears in art with Mike Kelley’s *Educational Complex*. Reviewer Whitney Moon of John Miller’s *Mike Kelley: Educational Complex* asks, “how might artists expose architects to the

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conceptual (i.e., discursive) potential of the architectural model?“62 Sculptor Mike Kelley’s *Education Complex* is a collection of bland, white, scaled architectural models in Plexiglas, sitting on sawhorses over a mattress on the ground. While at first glance this work appears as a scaled, literal model, viewers come to realize the piece is a fabrication of buildings from Mike Kelley’s childhood, constructed from memory. John Miller subsequently wrote a book series on the project, discussing its complexity in blurring the lines of what a model can be and its critique of art education and discipline.63

![Figure 12: Installation view of Mike Kelley’s Educational Complex, Rooseum Center for Contemporary Art, Malmo, Sweden. Photo by Göran Örtegren. 1997. From Mike Kelley Foundation for the Arts.](https://mikekelleyfoundation.org/artwork/educational-complex)

Mike Kelley’s work signals a transition of the use of models from spatial representations of objects to art and concepts and questions the role of a model as an idea.

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62 Ibid.
63 Moon, “Review of Mike Kelley: Educational Complex by John Miller.”
communicator and a creativity engine. Lastly, the work illuminates that the model can communicate both objective and subjective messages - the technical and sculptural.

Designer and MIT professor Neri Oxman’s Krebs Cycle of Creativity (KCC) describes “the perpetuation of creative energy,” or how information is converted through different disciplines. The “creative energy” that comes from design, art, science, and engineering inform each other to create more creative energy in different fields. It is apparent that in many model examples, including Mike Kelley’s Educational Complex,

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65 Ibid.
66 Moon, “Review of *Mike Kelley: Educational Complex* by John Miller.”
design informs art, and art informs design. This play on artistic perception and designed production - perhaps extending to other areas of the KCC – is vital to understand creativity generation in the design process.

Digital models also can play a vital role in the design process. Christophe Girot, Chair of Landscape Architecture at ETH Zurich, emphasizes the importance of our connection to site through experience. He explains that walking the site and experiencing the land is essential for gaining an intimate relationship with the landscape.67 Unfortunately, he argues, that connection has been lost with drawing, leading to a “withdrawal” from terrain - also known as “perspectival imaging”.68 Girot claims that “perceptual relativity” offers a way to regain that connection.69 This is achieved with point-cloud scanning technology and 3D visualization.70 This results in a hyper-accurate representation of the land in the computer - the next best way to experience the land without walking the site, allowing for design testing through modeling.

Figure 14: 3D-Scan and Visualization, Shisendo Garden, Kyoto. Illustration by Matthias Vollmer. 2015. From Professor Christophe Girot, ETH Chair of Landscape Architecture. https://girot.arch.ethz.ch/research/digital-landscape-design-and-analysis.

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69 Ibid, 19.
70 Ibid, 22.
The versatility of models exemplifies their rich, adaptable properties as tools for design. From these examples, the model is a device that reaches beyond the purposes of representation for a client presentation. Models provide connection to material, serve as vital communication tools, and emphasize concept development. Models blur the lines of artistic perception and design production and allow us to participate in the phenomenological experience of a site in a non-physical form.

**Recent Approaches and Theories about Representation**

Recent theories of landscape architectural representational methods suggest further possibilities for models and making. In thinking about the design process as a vital part of the product, some authors suggest representational methods that reflect this process.

James Corner of James Corner Field Operations speaks about the ways in which we represent the landscape as a reflection of how we interpret and how we interact with it. Using the historical terms of *landskip* (*landschap*) and *landschaft*, Corner differentiates how we “picture” or “image” landscapes.\(^{71}\) While *landskip* is about beautiful representations of the landscape, it is surface level. *Landskip* is beautiful, but there is no imagery suggesting how one interacts with the landscape. On the other hand, *landschaft* portrays more diagrams and indicates the uses of the landscape and people’s interaction with it — the “eidetic processes.”\(^{72}\) Corner goes on to describe the methods and possibilities of eidetic processes in landscape representation, which include expanding the traditional plan, diagram, and section, to “hybridized and composite” techniques.\(^{73}\) Examples of this borrow from a multitude of disciplines — “ideograms, image texts,

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\(^{71}\) Corner, “Eidetic Operations and New Landscapes,” 133.

\(^{72}\) Ibid, 134.

\(^{73}\) Ibid, 137-142.
scorings, pictographs, indexes, samples, game boards, cognitive tracings, and scalings” are all mentioned. Corners argument for a liberation from traditional representation techniques creates the possibility of new modes of thought for the design process as well. Experimenting with new design methods and representational ideas can influence the design itself.

Figure 15: Detail from Älvsjö Gameboard Collage, 42 x 29.7 cm. Created by James Corner. 1999. From “Eidetic Operations and New Landscapes.”

Using hybrid techniques in representational methods is further supported by Nadia Amoroso’s Representing Landscapes: Hybrid. By combining existing

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74 Corner, “Eidetic Operations and New Landscapes,” 142.
75 Cooper, “Review of Representing Landscapes: Hybrid by Nadia Amoroso.”
techniques, “hybrid techniques” are formed, which communicate different ideas in different ways to designers, clients, students, and educators.⁷⁶ Amoroso’s book mentions both two-dimensional and three-dimensional representation techniques, mixing and matching them. There is no need to reinvent the wheel with the base techniques - they are just pushed farther with hybridity. These methods place an emphasis on temporal representation and qualitative and quantitative information dually communicated.⁷⁷ Specifically in regards to modeling, Amoroso mentions the importance of the historically-overlooked physical model in helping students make “deliberate design decisions” suggesting instead the “Reintroduc[tion] [of] model making into the discipline as a strategy of inquiry, not as a presentation object.”⁷⁸ Amoroso’s recognition of the role of making in hybrid representation suggests the working model can be a communication tool. In hybrid representations, visuals may appear messy, but communicate process with product clearly.⁷⁹


⁷⁶ Cooper, “Review of Representing Landscapes: Hybrid by Nadia Amoroso.”
⁷⁷ Ibid.
⁷⁸ Ibid.
Corner and Amoroso’s hybrid ideologies communicate a blur in the iterative, sketchy design portion of a project, and the client presentation. The line of process and product also becomes less apparent, borrowing concepts from both design and art on Oxman’s *Krebs Cycle of Creativity* (Figure 13). There is a call for sensing the beauty and power of effective design processes as a substitute to a lifeless rendering. There is potential for a hybrid approach to allow more time in the iterative design stage of the process, while less time is spent creating stress-induced hyper-realistic scenes.

**Digital Modeling Tools and Technologies**

It is vital to mention the proliferation of mostly digital design processes in landscape architecture. Digital processes may seem much more efficient; however, effective digital design processes require attention to hybrid modes within the digital space.

Young researchers are creating innovative, multidisciplinary methods of design and construction that solve issues of safety, cost, and communication. Landscape architects Adam Mekies and Daniel Tal mention the use of 3D printing in Design Workshop’s Colorado residential project. Scanning, digitally modeling, and 3D printing existing boulder pieces for the site saved a large amount of money in the field, as opposed to moving them around physically. This solved communication issues between the landscape architect, contractor, and client, and was overall more efficient. Hurkxkens et. al. introduces interdisciplinary collaboration with “Robotic Landscapes”,

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80 Oxman, “Age of Entanglement.”
82 Ibid, 43-45.
concerning a new autonomous terrain modeling tool that works on site. While continuously terrain scanning, a bot locates itself based on the scan, and moves soil around to create the spatialized input code of terrain from the landscape architect. The authors argue that the designer is brought closer to the site because the original design is realized exactly as input, and connects more to the performance of a site. While some schools may use technology like this, it is very specialized and expensive, and therefore difficult to bring into curriculums. Open-source tools may be the key to accessing the means necessary to introduce a student to similar technologies. Focusing curriculums on open-source software, as well as investing in interdisciplinary Makerspace hubs, may aid in digital hybrid design and fabrication methods. Even if schools don't have these tools yet, it does not mean they cannot use a making-based approach until then. There are simple tools and methods that students and educators can use right now, as discussed in Chapter Three.

Student Experiences with Model Making in Rutgers Department of Landscape Architecture

Despite a plethora of scholarship, only a limited amount has trickled into applied design curriculum pedagogy. Fast moving curricula and bureaucratic guidelines are barriers to introducing new research into staple classes. The problems students face in accessing modeling and making need to be addressed in other ways. To move from a scholarly professional reflection on modeling and representation to a student view,

84 Ibid, 293.
multiple interviews with students from the Rutgers Department of Landscape Architecture were conducted from May to September 2020. Questions pertaining to access, material, preferred methods, and obstacles were asked; anonymous student feedback is synthesized and detailed below. The anecdotes can be found in the associated tables.

Access

Many students expressed frustration at the difficulties in gaining access to spaces for making, both in terms of accessing fabrication spaces as well as digital software. Rutgers University is very spread out, with students having to take buses to different campuses, often multiple times in a day. However, many students note the difficulties of getting to the Rutgers Makerspace, especially with material in hand. Students articulate the desire for an in-house Makerspace. Students also have a difficult time accessing digital programs and elements of certain programs with their existing computers. Having a “shitty GPU” means waiting too long for rendering to take place. Updated hardware in the building, as well as more specified lists for a required laptop (if a student so chooses to need high-rendering power) could be provided. Plans for a new Visualization Lab will surely affect this outcome, however, COVID-19 has put restrictions on many progressions worldwide.

Materials

Many students brought up the role of materials in the model making process. Most students focused on physical materials, implying that the word “model” is typically seen as a physical, hand-made object first, rather than a digital one. For many students, ready-at-hand materials make a difference. Sometimes, there is no time to drive to the
art store, which is also too costly for many. Cheap or free materials are important, as students do not want to spend money. This also makes the student feel more comfortable with “messing up,” starting over, and participating in an iterative process with their model.

Instructors’ attitudes towards modeling, making, and material make a difference for students in the making process. Instructors that have a stockpile of materials to provide in class proves memorable for students and expresses connection with the student in understanding varying financial situations. Instructor encouragement for using recycled or found materials also helps students feel more comfortable with their modeling process. One student expressed their love of finding recycled materials to make models, since they did not want to spend money. Using objects around the house, provided stockpiles, the department’s lost and found, and other students as resources, the student claims they were able to be frugal while gaining inspiration during their design process. Using materials that need to be purchased may adversely affect a students’ design; if a student only has limited chipboard for a required laser cut model, they may be hesitant to manipulate topography drastically in the design. The underlying factors of cost and instructor direction affect student outlook on making physical models, as well as the design itself.
**ACCESS**

Right now, COVID-19 is a real preventer.

If the makerspace resources were in the building, people would use them all the time.

It would help if there were an official field trip to the makerspace.

It would be helpful if the directions were a bit clearer in the Fablab. It would be helpful if the signage were better in there, especially for people who are just starting out. People should be introduced to it early on (first year) since its such a great resource.

I'd love to learn how to use a CNC model but as far as using the mitre saw and table saw, I feel like I'm hesitant because I'm afraid of hurting myself.

Sand table: I knew about it by word of mouth and I think a professor mentioned it a few times, but our class has never been brought to the sand table and shown it as a group and how it works.

For grads, Vis 3 was an elective. Rendering was not a part of the grad program at all. Unless you were informed of that or got the memo, you didn't do it. People were frustrated that they didn't have access to that knowledge.

Also, my computer can't handle it. Like I can't afford Rhino to pay for it and I can't do SketchUp because it's also expensive. But my computer, the GPU is really shitty, so it doesn't like to run 3D modelling so much.

With digital, there's a lot that is free, and there is also stuff that isn't free, that can be made free, if you know how to use the internet well enough.

**MATERIAL**

If we had a Blick, or if they collected a list of things we needed and put them in the bookstore for an affordable price, that would be the best thing.

Perhaps something that stops a lot of people from making models is the price for students and the overall cost of using the laser cutter if it means buying your own and even buying the material.

At least in [professor]'s studio, she was able to provide us some materials which we used - but not all professors have that on hand.

I think depending on what your design is and how much topo you have: that means you need to have more chipboard. That could affect how much money you spend - and if you have more topo to show, you have to pay more.

With the lost and found area, there's a lot of things just sitting around that you could probably use, or just using your classmates as a resource. I think most people feel comfortable asking somebody for help with resourcing material.

I personally don't want to buy anything, so I find plant material outside, or stuff at home. I think this is another way of being creative and trying to repurpose things.

Using the makerspace, I feel like I can't really use home found materials as much.

I originally wanted to do a scaled hand model but time, money... and digital is always easier.

I think the process of [digital] 3D models was something that was insanely easy and cheap.

Figure 17: Anonymous quotes regarding access and material in modeling. In conversation with author. May-August 2020.
Challenges

Students expressed a variety of frustrations and challenges with their modeling experience, including lack of introduction to tools, pressures of representation, and time. Some students noted dissatisfaction with their experience of digital modeling tools. Graduate students especially expressed frustration in lack of access to the digital modeling course, which wasn’t required in their curriculum. Budgeting is an issue for many schools, and resources are slow coming, which is understandable. However, students feel the need for high-tech processes and visualizations to compete with resource-rich design institutions. In terms of fabrication, one student noted their understandable fear of woodshop tools. While easily accessible woodshop tools remove barriers from students using them freely (especially in the in-house Fablab), it also creates possible dangers. This could be addressed by introducing training for the woodshop, as well as introducing students to the Makerspace, into the required curriculum. Recent changes to the Rutgers Landscape Architecture department’s curriculum now introduce students to the Rutgers Makerspace in 3D Digital Design and Communication (11:550:350) and to the Blake FabLab, with training, in Construction II: Materials and Assemblies (11:550:341).

Students confirmed that they often use the model mainly as a representation piece. A final model is often listed by professors on the syllabus and assignment sheets as a required deliverable. While some course instructors encourage “quick and dirty” study models, students find this confusing at first. It is a problem if instructors expect only beautiful models, because it influences a student’s perspective on the role of models. Having a discussion early on about the role of a model is essential to break the distinction between representation and process.

Lastly, time is the most daunting challenge for students. A typical 16-week studio is a short amount of time for a full studio project to be carried out. Not to mention other courses, jobs, organizations, social life, and sleep (what's that?). While course instructors make efforts to keep studios on schedule, the mad rush of deliverables always comes at the end - and the model on this deliverable list is typically the last priority. Incorporating dedicated class time to model exercises may be a solution to keep students focused and define expectations for the outcome. This will ensure that students are experiencing modeling in the first place. As discussed later in the thesis, it is possible to change our outlook of “wasting time” on a model to “forging time” with the model.
Figure 18: Anonymous quotes regarding challenges of modeling. In conversation with author. May-August 2020.
Benefits

Some benefits of modeling for these students are noted throughout the interviews. These include scale recognition, team-building coordination, process, and play. The power of a model to help students understand the scale of spaces is eye-opening. Design changes can be decided and changed more rapidly once the scale of a space is clearly understood. One student mentioned the benefit of seeing and feeling an immediate verticality in their site that they could not imagine in plan and section. While it is not precise or exact, it also helps to communicate a design idea very quickly to an instructor or peer for feedback. Team building and coordination can also be explored through making and modeling. In one collaborative model, students had to figure out how their sites fit together – the models aided in this exercise as communicative design tools. These student experiences are similar to those expressed by Megan Lotts in her 2016 article “Floating castles, Legos, Candy, and Play: Counterplay 2016.” This work describes Lotts’ making experience as a collaborative tool and uses Legos to bring people and ideas together in her role as Rutgers Art Librarian.  

Students express their experiences of preliminary modeling on their own, either unprompted or encouraged as optional by the instructor. Students who have experienced this find it helpful and yearn for more expansion on this design tool. One student reflects:

We are taught ‘here is how we want the model to look like with chipboard blah blah’ and that’s kind of where the image of the model ends for a landscape architecture student… Maybe emphasizing the fun of it and not making it feel like it’s a means to an end and it’s just about a grade can make people feel more invited to the idea of model-making. 

87 Anonymous Student, in discussion with the Author, May 2020.
Some students are recognizing the value of models in this way and continue to use these practices. However, a distinct emphasis on model as process from an instructor will greatly affect the outlook of models for students. Students interviewed for this research generally found these models to be fun and explorative. There is an element of play associated with the design process that is highlighted in using tools to shape ideas that break the status quo of pencil and paper. This playful approach acts as a motivating force to keep going with an idea that has them excited.
BENEFITS

I feel like all of the modeling itself is helpful, especially with trying to understand the scale of the site and determining whether or not something you're putting in the design is actually going to work for the site.

In the 2D plan, it is very hard to tell the verticality of everything – there were a lot of slopes and drops, so just having the model helped us figure out how to actually physically put the sites together and how that would look.

Instead of going to the [site] everyday and making that drive, having the actual scaled buildings and roads and river (big key elements of the design) let us change things that we wouldn't be able to see if we were just visiting or doing it as a drawing.

We did change a lot of things after doing the model, like our first model was completely different than the second one.

I think the point of a model is “a theater of the mind” so that you can dive into a space and almost see yourself within it and I think that experiential aspect of model making is critical.

Craftsmanship is really important in making [the model] recognizable as what you're trying to portray it as. That is a skill that needs to be learned and developed over time.

I like that there is a group aspect to machine modeling. There’s always other people around and it is collaborative. There is more of an opportunity for an iterative process with machining.

[One modeling study] was more about concepts, not super precise - we scaled everything down so it was a lot easier to work with and we had already had a lot of experience with modeling so we felt like we knew what we were doing.

I think it helped our group try to figure out how our three individual designs were going to come together and meet.

I used the sand table in [professor's] studio when working on my grading, which I feel like was very helpful - so that was a different way of modeling.

But that helped to visualize the site, which was so big and hard to scale in my mind. It wasn’t precise or exact in any way, but it helped me explain my design to [the professor] or someone else, so they could understand and help me with my design, especially when I couldn’t actually draw it out or explain it with words. But it also helped me to visualize the verticality of it because I was doing a lot of grading.

When the class modeled those planters and put the actual scaled plants in, I really liked that. It made it look so much better than what I actually visualized it to be. It gave me drive and “let's keep building...”

Model making almost forces you to think on a process level as opposed to a formative picture level, the way rendering in a three-dimensional space does, and it allows you to bring it down to a more human scale.

Figure 19: Anonymous quotes regarding benefits of modeling. In conversation with author. May-August 2020.
Conclusion

Building off this review of literature, I created a plan to test making-based exercises in the design studio. From these exercises, several additional themes regarding the student experience with models emerged. These include physical and digital access, material cost, instructor attitude, introduction to tools, process modeling, time, team coordination, and play. Working from multiple angles of instructor and student experience, the results bring to light interesting themes that build on the interview data collected. The next chapter outlines these experiences and analyzes the resulting student work.
**Interlude II: Rhino Print**

A traditional and typical use of modeling does not just come before conception of design, but after as a representation... and may possibly turn out to be more. Although this thesis discusses the placement of the model-making step within the design process as a malleable idea, we must recognize the standard viewpoint from many individuals within the architectural education realm: model as representation. This second making exercise stems from the Spring 2020 Material Tectonics class taught by Vincent Javet, which took place during the turbulent start of the coronavirus pandemic in America. This meant a lot of scrambling for the final goals of the class – what was supposed to result in a funded built on-campus installation turned into a scaled 3D print model. My expertise in using 3D printing machinery meant that I took the lead in making the physical product of my classmate Michael Scott Bey’s\(^\text{88}\) design a reality.

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Creating a 3D printed product meant a mindset switch, not just for me, who had the closest connection to translating the model to the printer, but for others who were helping in making the Rhino model in the first place. Only certain geometries can be translated to the printer – it takes a precise skill to model correctly for a printer or other CNC machinery, as compared to modeling for a render that lives digitally or on 2D print. It takes knowledge of what we are modeling and recognizing thicknesses that can actually be printed with the printer nozzle width that we have available to us. It also takes recognizing which type of 3D printing method is most suitable for your product. We chose a mix of FDM printing and resin printing.

The first step in this was communicating to my classmates these mindset switches within the modeling process. A short presentation was made, and video sent out with instructions on how to create appropriate models for 3D printing. Despite having this information, as I received Rhino models from my classmates, I realized repair work had to be done and models tweaked. I thickened walls, meshed objects, repaired meshes, all using manual and automated (plug-in) techniques. I was switching between Rhino and the 3D printer-specific software to ensure the model was translating correctly from platform to platform.

There were other limitations involved. I had to consider the available size (volume) of the printing bed, making sure the objects could fit on there. This took splitting the large deck mesh into three parts. I was also aware that my FDM printer (Prusa i3 MK3S+) was a single extruder printer; I could not have a dissolvable support material in addition to my regular PLA/PETG printer material – this meant the models had to be okay to print without having dissolvable supports. This includes paying special attention to overhead angles of components in the model and orienting them so that they are structurally stable enough to print.
Many materials were considered, for aesthetic and utility qualities. A red PLA was chosen as the main base color for the scaled site model (are Plaza) and for the people and base of the site, a clear resin was chosen. The clear resin was also used for a 1:1 print of a custom joinery piece used in the site. Although material research changed from actual built materials of wood, nails, and concrete to printed plastic filament and resin, we still had to think about how this would affect our final product.

The final translation process lasted well after the semester had ended; it included talking to other 3D print techs, transporting material to and from site, figuring out payments, and getting the final pieces to assemble. Multiple parties were involved in a back-and-forth email process for a good amount of time before a physical product was made. The process took a much longer time than expected, before we even got to the assembling part. We must remember that typical studios do include time limitations,
potentially deterring students from producing a large, scaled site model out of 3d printed material.

Through the assembly process, methods were developed such as using small objects that could hold up the planter slats at uniform height, creating jigs to hold materials at a 90-degree angle, and holding other objects in place for gluing. The process took many trial and errors and items had to be redesigned, reprinted, and reassembled a few times. Here we recognize the ease and limitations of both digital and analog model work: we simply can split and mesh objects in a digital program, but physical space needs to allow for factors such as air flow and temperature affecting glue drying rate, and gravity limiting holding objects to a certain orientation. I could have used an extra set of hands.

I also noticed design questions came up while assembling the final product. I noticed that a central ramp on site was not centered – very slightly off, although it appeared to be centered in other drawings. Was this a result of design intent, or translation process malfunction? Multiple times I reached out to the designer to ensure that the design was correct and not a result of one of the many transformations the model had to go through to become a 3D print. With less of a time crunch and more accessible 3D printers, this would become more of an iterative process – quickly reprinting pieces to ensure that all parts of the design are smoothed out, mistakes that may not be so recognizable in a drawing.

There was a satisfaction to making this model – the amount of time put into it outside of class, and the finished product of a physical thing is still something to be very proud of, even if it isn’t a true scale real on-campus installation. The ability to put together tiny, fragile pieces into a cohesive, readable, measured model after weeks, even months of process work felt substantial and like there was a satisfying conclusion to the product. Creating and producing three-dimensional objects may motivate you to
make more iterations of that work or keep working on different products within the design process, stimulating creativity and option-making.

Overall, this exercise was about logistics and realistic products. Although classes may not have the time, funding, space, or climate to make a real installation, having a piece of machinery that can create measured scaled models is still an exercise in translation from design and drawing to physical product, considering travel, cost, material, communication, teamwork, and design intent. The new field of fabrication is exposed to the student, allowing for them to learn concrete skills and techniques to make something physical, while also providing a neat, measured final product of representation.

The goal of this model is to be used as a piece in a gallery, representing what the landscape architecture department does and is capable of, as well as what you can make with the tools available at the school’s makerspace. Although this might be seen as a “representational tool” to just us students, it is actually a major player in realizing where funding may need to be directed within the larger university, and the possibility of collaboration between two separate entities at the university.

If timing and climate surrounding the project were different, this process had the potential to be used as an iterative design tool earlier on, having the ability to reprint pieces as seen fit by the designer. Although the real project was not built, it is still a valuable, low-cost option to sort out design discrepancies before spending a large amount of money on building the form and realizing design discrepancies at that stage.
Figure 23: Rhino Print completed. Photos by author. September 2020.
Chapter 3: Making-Based Studies in the Design Studio

I write this as we approach the one-year anniversary of the transition to online classes at Rutgers University due to the COVID-19 pandemic. I realize the state of education has changed drastically. As we all try to wade through Zoom classes and online learning platforms, another piece to this educator-student relationship has been brought to light, despite the distance between us. The collective trauma of a worldwide pandemic has instilled more compassion in the relationship between educator and student, leading to an understanding regarding final deliverables, deadlines, grading, and an increase in the understanding of the challenges facing students in trying to get work done.

Despite the irony of the digital screen separating us from our studio spaces and Makerspaces, this has only strengthened my belief in the importance of a making-based approach. This approach connects strongly to pedagogies of compassion, humanity, and individuality that are so important in this time. A making-based approach, whether deployed virtually or in-person, encourages a form of learning that is based in the strengths, passions, weaknesses, and pains that students bring with them into the university and into the classroom. It encourages listening to what students want to bring from their personal experience into design education and exploration.

While in many classes students look to case studies and the techniques of others for inspiration, this approach allows students to rely on their own personal knowledge and experiences for design brainstorming. While students are always free to engage in such explorations on their own, this is hard to bring into the classroom without the educator's compassion and support to validate students' personal histories and experiences in the academic realm of landscape architecture. Embracing making-based approaches in landscape architecture pedagogy can allow more room for the channeling
of individual skills and interests into the design process. A sense of agency in one’s
design process motivates students to be self-driven and make the rules to guide their
own work.

Instructors may wrestle with the question of how to balance compassion with
holding students to a “standard” and encouraging them to put their best work forward. By
following more general frameworks within a making-based approach and giving the
space for self-governing individual or group work in the design process, instructors can
encourage students to bring their interests and histories into this design process. There
is no room for “forcing” students to explore one way or another - if a student is not
passionate or deeply interested in the topic or approach, the work will likely not be
successful. However, by highlighting the making-forward mindset of accessing their own
interests, knowledge, and research, students may be more inclined to participate and be
self-driven in the studio.
Figure 24: Collection of memes and personal photos. Memes by [@TheLandscapeofMemes] on Instagram and Twitter. Photos by author.
Every student will have their own stories about the downsides of studio culture. The pains are well known, as a plethora of memes, personal photos, and design studio war stories will show. I can also reflect on my time as a student in my undergraduate study, tired, unwilling, dreading a final pin-up. The night before, preparing for an all-nighter, I heard this: “I don’t believe that she can do it. I don’t believe she can pin up her work in time. I just don’t believe in her.” Yes, this is something an instructor said about me to another trusted source. It hurt. And I really believed it! I proved the educator wrong, finishing a piece I am very proud of.

Such stories are common in university design classrooms around the world. Students are lucky to be able to work with instructors who have strong visions, and who encourage final products that may win awards. The work may not necessarily reflect the students’ design ideas and skills, but rather serve as an extension of the educator’s interests. The results of such studios can be cohesive, beautiful, and evocative. There are moments that I am happy I was pushed that hard - I don’t think my final product would have come out as developed or as beautiful without that push.

There are many good qualities here, but these kinds of common stories and experiences raise several questions that are worthy of consideration in design pedagogy. I consider these now as I look back and reflect on these experiences. While enough time has not yet passed for me to have solid answers, I do wonder how much I was able to draw on my own interests, talents, and expertise in such overly scripted studios which seemed pre-directed towards a particular narrative or end point. While I did bring in my artistic skills and particular ecological interests, I’m not sure that I was able to direct them in directions that I chose myself - which of course would be unreasonable. For the projects to be cohesive and to meet the instructor’s goals and standards, some agency - some individuality - must be sacrificed. Students will go along
with the structure; they want the good grades, and they will be led by the norms of the instructor and by the norms of studio culture. These are well known colloquially - certain schools have certain styles. Many can look at a rendering and guess if the project is from Harvard GSD, from Penn Design, or UVA. Others would argue that it is hard to differentiate between these schools since they all follow the same design cannon. Certain firms will recruit from certain schools. And the cycle continues.

I argue that a making-based approach offers a vehicle for students to bring other creative inputs, ones that are very personal and individual, into the design process. This can help to stretch design studio education beyond the norms of the discipline. A making-based approach draws on the interests and values that students hold. The importance of this is coming more and more to the forefront of discussions about design education that began in the summer of 2020 after the protests following the murder of George Floyd. A slew of conversations began about what is taught in design schools and whose traditions are honored, and whose voices are heard.

As several major institutions published statements regarding their solidarity with the Black community, a deeper dive into the racist infrastructure of architectural design practice commenced. The Black faculty of Columbia University’s Graduate School of Architecture, Planning, and Preservation (GSAPP), like many other schools, published a statement including their goals for the 2020-21 year. These goals included to “develop pedagogical approaches and curricular content that no longer advance white supremacist values or practices” and to “actively transform the culture of the school into a culture that promotes safe, authentic, transformative care, practices and dialogue while dismantling white supremacist, patriarchal and ableist power dynamics at all levels.”

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focus on the reform of pedagogical practices and school culture signals a need for change in the relationships between faculty and students. It is noted that this is not easy or quick work. This discussion has also made an impact on hiring practices in established firms, as they have made decisions to hire graduates from a broader range of universities.  

At Cornell’s College of Architecture, Art, and Planning (APP), students of the Cornell University chapter of the National Organization of Minority Architects Students (NOMAS) also expressed their concerns to the school, making demands for justice in curriculum, representation, outreach, and studio climate. These statements from both institutions and students recognize the need to reexamine design schools at various scales to ensure safe and equitable learning environments. They recognize the discipline as rooted in racism, and the new forms of racism that appear within the practice and theory of architecture. And they make plans to take an introspective look at their own practices.

While this is a recent reckoning, architectural sociologist Gary Steven’s work from the 1990s on the social foundations of architectural distinction, illustrates that this has long been an issue in design education. Both the AIA and the ASLA were organizations run for and by a particular type of professional man. This did not leave

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room for other approaches. As he argued, some people will be more capable of “playing the game” because of their *habitus*, or socially ingrained habits, skills, and dispositions.

The children of the privileged can get by on less institutionalized capital than others because their *habitus* provides them with an intuitive feel for the game they want to play – their embodied capital more than compensates. Where the newcomer must struggle to understand all the subtle, covert, taken-for-granted social rules that govern the game, the privileged just follow their own dispositions.\(^\text{92}\)

If this is the case, then it seems clear that we must disrupt the game entirely if we want to create a fair playing field. While the making-based approach that I propose does not directly engage with issues of race and class in design education, those are key considerations that have influenced my approach. The question of access is key: who has what materials or tools and who is making these accessible or participating in open-source systems? But most importantly, access is about encouraging different kinds of people bringing different kinds of skills and interests into the design process.

My vision for an ethical landscape architecture curriculum and studio culture is one that motivates students by encouraging them to explore their personal histories and interests in a way they find most effective. The role of an educator is to facilitate this process, rather than control it. This is reflected in Roland Barthes’ *To the Seminar*:

> The space of the seminar has its rules (a game always does) but is not regulated; no one in it is the “foreman” of the others, no one is there to supervise, keep accounts, amass; each member, in turn, can become the master of ceremonies; the only distinction is the initial - there is only an initiating figure, whose role - it is only a gesture - is to put the ring into circulation.\(^\text{93}\)

The facilitation of flexibility and playfulness invites students to a more comfortable space and results in a variety of design processes and outcomes. The educator-student relationship is an understanding one, recognizing and adapting to the

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needs of one another. What I have loved about my own landscape architecture education experience in the Landscape Architecture Department at Rutgers University is the diversity of people, ideas, and processes that is affirmed by many educators in the studio. However, this can be strengthened by building it into the curriculum standards by instructors; and on a larger scale in the influential landscape architecture education organizations ASLA, LAAB, and CELA.

The studio experience that I mentioned earlier highlights the importance of the presentation in the process. The “look” of the project, its representation, and the communication of general concepts has great impact on what wins awards. Therefore, students are focused on final deliverables (either models or drawings) as finished representations. A making-based approach will include many “ugly” deliverables. There is a shift here from product to process, and some of the themes that I discuss in this chapter are connected to important lessons that come from this process. I argue that when students are more engaged and responsive to what they think is important about the design, this changes the process in significant ways. This allows students to think about the details of the design, pulling attention away from the beautiful representation that one is supposed to achieve at the end of the process.

This chapter details the process of integrating making-based studies in both the Sophomore *Introduction to Environmental Design Studio* (11:550:231) and the Senior *Advanced Landscape Architecture Housing and Open Space Studio* (11:550:431) in the Fall 2020 virtual semester. The “experiments” were created to test different structures of making exercises for students involved in an active studio course. These techniques were then evaluated on how effective they were for students’ design process and experience.

The sophomore studio is the first landscape architecture studio that students take in the curriculum. The instructors and I did a simple introductory exercise with the
students involving folding paper; the project was not attached to any site. The senior studio is the final required class in the design sequence. With this smaller group of older students, the instructor and I introduced a series of making exercises throughout the semester. These were geared to a particular site and goal, as the students worked with a client on selected sites in Newark, New Jersey.

The first section of this chapter goes over the LAAB (Landscape Architectural Accreditation Board) accreditation standards and procedures. Then, this chapter explains the “making experiments,” showing some examples of the results. I describe how these exercises fit into existing landscape architectural education standards. The next section then examines major themes discovered through analysis of the results and personal reflections written by the students. The conclusion outlines major lessons learned from the making exercises and what they mean for the creative process.

Reviewing the students’ models and personal reflections, I looked for patterns in their responses and experiences. This analysis offers information about how these making exercises could be refined. The next chapter offers a resource in the form of a website, which serves as a hub for making-based tools. This resource is informed by my analysis of these exercises.

**Curriculum Standards and Studio Experiments**

**Standards**

According to CLARB (The Council of Landscape Architectural Registration Boards), to become a licensed landscape architect, one must attain a LAAB (Landscape Architectural Accreditation Board) or LAAC (Landscape Architecture Accreditation Council) accredited degree in a four or five-year program. There is then a four-part examination that tests mostly technical skills required to become a practicing landscape
architect to protect the safety and welfare of the public. At the same time, the junior landscape architect must gain experience working under a previously licensed landscape architect for a minimum number of years according to each states' requirements. Then the junior landscape architect may apply to become a licensed landscape architect in their state and may acquire different licenses in different states.94

The goals for aspiring landscape architects are outlined on the ASLA (American Society of Landscape Architects) website.95 Those outlined learning goals include:

- Sensitivity to landscape quality
- Understanding of the arts and a humanistic approach to design.
- Ability to analyze problems in terms of design and physical form.
- Technical competence to translate a design into a built work.
- Skills in all aspects of professional practice including management and professional ethics.

According to CELA (The Council of Educators in Landscape Architecture)96, their mission is to further education in landscape architecture specifically related to teaching, research/scholarly works, and service:

We do this by engaging in scholarly activities between students, faculty, and public/private practitioners. The development and management of curricula, the generation and diffusion of knowledge, and the promotion of public health, safety and welfare are key to our purposes.

While ASLA and CELA play a large role influencing current areas of interest in landscape architecture programs, programs must abide by LAAB’s standards to be accredited. Accredited programs must voluntarily participate in the LAAB accreditation process, ensuring their program goals, mission, and curriculum ensure that students are qualified to enter the profession. According to the official 2021 LAAB “Accreditation Standards for Professional Programs in Landscape Architecture” document, “diversity,” “equity,” and “inclusion” are three main guiding principles included in the definition sections.\(^9^7\) These words are detailed in “Standard 2: Program Autonomy, Governance, and Administration”, requiring a “commitment to diversity, equity, and inclusion through… recruitment, development, and retention.”\(^9^8\) There is further requirement of coverage of diversity, equity, and inclusion in the programs’ curriculum under “Standard 3: Professional Curriculum.”\(^9^9\)

LAAB has taken a big step to include the topics of diversity, equity, and inclusion in the latest edition of standards, even adding “diversity” to the values of the LAAB in the 2021 “Accreditation Procedures” document.\(^1^0^0\) However, there is still room to include these guiding principles in the student outcomes and curriculum standards sections. If LAAB wants to ensure a diverse, equitable, and inclusive environment for students, there needs to be a more comprehensive discussion about studio climate standards and instruction concepts that enforce an ethical studio environment.

There is room within this curriculum structure to create a framework for a making-based approach that can satisfy the technical requirements of the accreditation and

\(^9^7\) “Accreditation Standards for Professional Programs in Landscape Architecture,” 2.
\(^9^8\) Ibid, 9.
\(^9^9\) Ibid, 11.
\(^1^0^0\) “Accreditation Procedures for Professional Programs in Landscape Architecture” (Landscape Architectural Accreditation Board, January 2021), https://www.asla.org/uploadedFiles/CMS/Education/Accreditation/LAAB_ACCREDITATION_PRO CEDURES_JANUARY2021.pdf, 1.
licensure process, while also providing new directions for landscape architectural education. This is a small intervention that does not require a complete rebuild of the curriculum but would enhance student learning in many ways, as I outline below with making experiments.

The experiments refer to a set of making exercises and associated questions to ask students about their impressions of the exercises. The goal of these experiments is to investigate how these making exercises, in conjunction with already established class coursework, affect the students’ learning goals and design process. By analyzing the written reflections, I was able to derive conclusions about how making allowed students to access creative alternatives.

**Sophomore Studio**

The first making experiment took place with the sophomore class in the *Introduction to Environmental Design Studio*, where they first encountered the landscape architecture design process. I would like to give a special thank you to Holly Nelson and Dr. Frank Gallagher for allowing me the opportunity to conduct this experiment in their class. We brainstormed together about an exercise that could serve as a playful introductory activity. This exercise used the model as a tool for play; an introduction to three-dimensional thinking in landscape architecture; and to analyze how students follow directions and how they might bring creative expression into a structured exercise.

In class the students watched a video of the origami artist Tomoko Fuse. They then answered some “pre-making questions” in their journal and began to try and document some basic exercises from origami artist and instructor Paul Jackson’s book,

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101 Raisa Hinrichs, Tomoko Fuse - Infinite Origami (Freising, Germany, 2015), https://www.youtube.com/watch?v=0g-y5825xkk&list=WL&index=14&t=1s&ab_channel=KarstenHinrichs.
*Folding Techniques for Designers: From Sheet to Form*¹⁰². For homework we asked students to read Catherine Dee's "Form and Fabric in Landscape Architecture," and to make and document a hybridized form by combining techniques from three of Jackson’s exercises. The next day, we discussed the exercise and process with students in Zoom breakout rooms, going over post-making questions, detailed in the students’ journals.

<table>
<thead>
<tr>
<th>IN-CLASS STEPS</th>
<th>QUESTIONS</th>
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<tbody>
<tr>
<td><strong>DAY ONE</strong></td>
<td></td>
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<tr>
<td>1. Watch a video of the origami artist Tomoko Fuse</td>
<td>What was the basic technique used by Tomoko?</td>
</tr>
<tr>
<td>2. Answer “pre-making questions” in journal</td>
<td>What are some “making” or design techniques you are familiar with?</td>
</tr>
<tr>
<td>3. Make and document basic exercises from origami artist and instructor Paul Jackson’s book, Folding Techniques for Designers: From Sheet to Form</td>
<td>How do you think techniques are developed?</td>
</tr>
<tr>
<td><strong>HOMEWORK AND DAY 2</strong></td>
<td>What are your thoughts on your finished product?</td>
</tr>
<tr>
<td>1. Read Catherine Dee’s “Form and Fabric in Landscape Architecture”</td>
<td>What did you learn about your approach to technique and creative process over the course of the project?</td>
</tr>
<tr>
<td>2. Make and Document a hybridized form by combining techniques from three of Jackson’s exercises.</td>
<td>How do you think this process relates to design of landscape as a fabric or network?</td>
</tr>
<tr>
<td>3. Discuss the exercise and process in breakout rooms, going over post-making questions.</td>
<td>Rate how you thought the exercise went – what parts were easy or frustrating / did you like it or not and why?</td>
</tr>
<tr>
<td></td>
<td>How much time did you spend experimenting?</td>
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<tr>
<td></td>
<td>How do you feel about wasting time in creative process?</td>
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</tbody>
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Figure 25: Instructions given to students for Sophomore Model Study Exercise. Table by author. September 2020.
Figure 26: Results and documentation of Sophomore Model Study Exercise. Photos by anonymous students and compiled by author. September 2020.
Senior Studio

I then executed a series of “making experiments” with the senior class in the Fall 2020 Advanced Landscape Architecture Housing and Open Space Studio. I worked together with instructor Dr. Anita Bakshi to develop some ideas for making-based exercises in the summer, and then as classes progressed in the fall. The studio was focused on creating multi-scale design strategies for Science and Sustainability Newark, a client based in Newark, New Jersey.\textsuperscript{103} Students studied the current Land Bank Program in Newark, Newark’s \textit{Sustainability Action Plan}, and many precedents and models as they moved forward with their design. I want to extend my gratitude to Dr. Anita Bakshi and the students in the Fall 2020 course for allowing my continued involvement in classes and presentations.

The four model studies were conceived for several purposes. These included the creation of experiential models for learning about the site since there was no class field trip or site analysis due to COVID-19 restrictions. We wanted to use models to change scale in thinking about Newark as a whole, from a regional level to connections between sites, as well as specific site design features. We also wanted to explore making and modeling to change modes of making, shifting between analog and digital methods.

The students were given a model kit before the semester started, with base materials including yarn, wire, balsa and basswood block scraps, clay, and a make-your-own interchangeable 3D pen, wood burner, soldering pen, and foam cutter device. This kit was given to students for free and was to be used throughout the semester in the four assigned model studies. Model studies were not fully conceptualized prior to the

\textsuperscript{103} Department of Landscape Architecture at Rutgers, 2020, “This year the senior studio (Assistant Professor Anita Bakshi) is working with Newark Science and Sustainability and it’s Director Tobias Fox to generate design ideas for several lots he recently acquired in Newark’s West Ward,” Facebook, October 22, 2020, https://www.facebook.com/rutgerslandarch/posts/3541515845907079.
beginning of the semester. This approach led to having an adaptable set of deliverables and allowed for adjustment according to instructor, student, and client needs. As the semester went on, goals for model studies could be determined to suit the project’s direction.

Students started with context in Model Study One, using wooden blocks to explore possible urban layouts and densities for the city of Newark. In Model Study Two, students zoomed into their specific sites within Newark making hand-made models, focusing on their sites’ connection with the first study. These more detailed models were then translated into digital models with Rhino. Students explored play in Model Study Three, instructed to let loose and make a “freeform thing” by hand with any desired materials. They then used Photoshop to collage their models with photos or drawings of other models or their site. The final model study had students use Grasshopper (a visual scripting tool for Rhinoceros) for the first time, using open-source scripts to explore a specific element in their design. These grasshopper-generated models again were collaged, and this study signaled a move to a more final “representation mode.” All model studies required documentation and reflections in the form of in-class discussion and discussion posts. Models made up a lot of design time for students in class and were highlighted in the presentations to clients and guests.
<table>
<thead>
<tr>
<th>IN-CLASS STEPS</th>
<th>QUESTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Lay down your printed site plan, or translate the existing streets and building massings to a new piece of paper.</td>
<td>How did the process of going from 2D (computer screen and paper) to 3D (wood blocks) change your understanding of the site?</td>
</tr>
<tr>
<td>2. Point out the important sites in Newark that you saw or heard about from the client on your model.</td>
<td>Did this exercise change your design approach?</td>
</tr>
<tr>
<td>3. Use the wood blocks to explore possible densities and urban layouts for new street formations, and housing and open space layouts.</td>
<td></td>
</tr>
<tr>
<td>4. If you want, you can add other layers to the model, denoting connections or other meaningful context information.</td>
<td></td>
</tr>
<tr>
<td>5. Document throughout the entire making process with photos or timelapse video.</td>
<td></td>
</tr>
<tr>
<td>6. Answer discussion post.</td>
<td></td>
</tr>
</tbody>
</table>

**MODEL STUDY 2: ZOOM IN**

| 1. Zoom into the site you are working on and create a hand-made model of initial design interventions. Think about the existing connections you made from Model Study One. | What did you learn from the Model Study 2 exercise? |
| 2. Try to use materials and techniques that will photograph well for midterm presentations. | How was the process of translating the physical model studies into a digital model? |
| 3. Translate this model study into a digital Rhino model, keeping in mind rendering for the midterm presentation. | |
| 4. Answer discussion post. | |

**MODEL STUDY 3: PLAY**

| 1. Choose a material or tool and work with it in a way that you find interesting. You don’t need to have anything specific in mind, just loosen yourself to the creative flow. | Please write one paragraph describing your experience with Model Study 3 - was it helpful? |
| 2. Watch the presentation about Thomas Heatherwick’s making process if you need inspiration. | Were you able to develop any creative ideas for your design through the process? |
| 3. Take photos of what you created. | |
| 4. Begin to collage in things from your drawings and other model photographs (whatever you want). | |
| 5. Create a very detailed model of some aspect of your site. | |
| 6. Answer discussion post. | |

**MODEL STUDY 4: GRASSHOPPER**

| 1. Prepare the detailed model of the structure for today’s exercise (bench, pergola, etc.). | What did you think of the Grasshopper Experience? |
| 2. Create a new Rhino file and copy in your structure 3D model. | |
| 3. Copy that structure and separate it into parts/geometries. | |
| 4. Choose a grasshopper script or multiple scripts and apply them to manipulate the geometries. | |
| 5. OPTIONAL Ladybug analysis of sunpath / shade. | |
| 6. Put it all back together and see what you have! | |
| 7. Answer discussion post. | |

Figure 27: Instructions given to students for Senior Model Study Exercises. Table by author. September-December 2020.
Figure 28: Results and documentation of Senior Model Study Exercises. Photos by anonymous students and compiled by author. September-December 2020.
Themes Observed from Student Reflections

After the completion of the model studies at the end of fall semester in December 2020, I reviewed the process of working with students and educators. A few key themes came to light from my discussions with faculty and students, and through the reflections written by students. These major themes provide insight into the design process, from a student perspective, and highlight benefits of a making-based approach.

Play and Inner Childhood

The most prominent theme observed in the student reflections connected to a sense of play. For instance, several of the sophomores made comments that the origami exercise created feelings of how they felt as children first learning how to make things in elementary school. One student wrote: “Learn the moves and directions first. If you don’t understand them first, you will get lost. Getting lost did lead to a fun snowflake design\(^\text{104}\) that I remember from when I was younger that is now a base for my hybridized fabric.”\(^\text{105}\) This statement tells us something about the importance of having fun or connecting to an inner child through making. Students can step back and be free of adult responsibilities and pretentions. This allows for a reshaping of ideas about how design is done from the standpoint of an earlier age. The action of getting lost and straying away from the steps felt fun and not so serious or demanding, reminding this student of their youth.

Students bring in knowledge through their prior experiences and hobbies, which may mean that they feel more comfortable with some techniques than others. One student claimed that they felt “comfortable with clay models, woodwork, 3D printing,

\(^{104}\) Figure 24, bottom left photo.
\(^{105}\) Anonymous Student, in written response to the Author, September 2020.
There will be varied comfort levels across the board, so it is important to make the project itself comfortable for the most intimidated students, but also allow for expansion and customization for more experienced students. Some students had no prior experience with origami and were more reluctant to accept it. This is inevitable in any curricular strategy for something as subjective as design. As discussed later in the chapter, there is no pressure for every student to have the same design processes and creative methods. The goal is to expose students to different techniques so they can learn what they like and what they find useful. Making-based exercises allow students to access creativity and to inject their own expertise and skills into their projects.

Model as Process and Where to Assign Models in the Process

Modeling can be overwhelming at first for students, especially if they are encountering a variety of materials that they may have not even touched before. “My model [as-is] definitely looks rough and maybe confusing at first, but to me it shows me what I want to achieve with this site.” Models may only make sense to the designer at first, and not be effective in communicating ideas to an instructor, classmate, or client. This is still a valid model, as it helps the student navigate through their design process. Modeling can not only reveal context and allow students to play with design ideas that are only in their minds, but it can also create entirely new ideas that weren’t there before. In that way, the model is an iterative tool, one that allows for dreaming, testing, recreating, and weeding out flaws. This process can be repeated many times. Modeling is not just about visualizing but feeling.

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A “free play” model allows the student to feel comfortable with the idea of modeling. The student doesn’t need to feel pressure yet for a complete design, however eager they might be to get there. The first and only model for the sophomore studio was “free play,” while the senior studio experienced this after some prior site modeling. The placement of the “free play” Model Study Three after some realistic, site-specific design and Rhino translation gave students a pause in production. This was effective for some students in being able to step back, but not all. While scale and accurate portrayal of the site are important during some phases of the project, there needs to be room for process models as well. This type of making provides important encouragement and can keep the design process moving when students may otherwise feel stuck.

According to Joseph Holtgreive at *Inside Higher Ed*, students are trained in a very linear way to receive information, study and learn it, regurgitate it, achieve a high grade, and work towards a final goal.108 Taking a step back from the original design allows students to just take a breather from the current workflow. This interruption may add to the design, or it may not. It may change it a bit. It may just allow an opportunity for reflection or a chance to reset and go back to earlier stages of the design process. This highlights the non-linear quality of the design process.

“Free model time” gives space for students to let go from what is currently going on in the class. One senior student expresses:

[The study] set my mind free to only think about shapes and lines. The first thing that came to my mind is a curved surface...it takes me out of the project to make a brainstorm and fantasize then organize the thoughts into a straightforward format - model.109

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In design studios, students are thrown into a fast workflow to get through the project within a limited timeframe. In general, and as illustrated by those common memes of students in architecture schools, this can cause a lot of anxiety and contribute to a lack of rest for students. This model time not only allows students to play with their design, but also offers an opportunity for rest. It offers time to disconnect, brainstorm, fantasize, organize, and implement. In other words, it offers time for many aspects that are important for the creative process.\textsuperscript{110}

Many sophomore students wrote about the importance of experimentation and trial and error in their pre-making questions. I am perplexed by this language because I think the word “error” – even if semantic – has an associated connotation, especially when we are discussing a very loose process meant to bring about ideas and creativity in the process of making. Error implies that there are elements that will not be used in the process the next time around. Perhaps we should just discuss the trial side of it more and encourage more trials. In this way, finding form can be encouraged through errors. This can be brought into the design studio process by forcing students into unfamiliar territory. Looking over the results of the simple paper folding exercise in Figure 26, we see that some students have completed projects that replicate the example, while others have achieved a range of different results. Could their errors be beneficial or even celebrated? How do educators change the stigma against accidents or mistakes and celebrate them in design? To connect this back to the initial arguments in the introduction to this chapter - such “errors” can be vehicles for students to bring other creative inputs into the design process. This can tap into skills, interests, and values that students hold.

As students move through the creative process, they will be met by many obstacles including perfectionist attitudes, opinions on craftsmanship, or the inefficient use of time. One sophomore student reflected on their piece: “My craftsmanship is not as good as it could’ve been. I had a difficult time folding the paper and had a hard time following. I kinda just wanted to get it done.”\textsuperscript{111} While sophomore students did need to learn some technical components of folding (how to get straight lines, how to fold symmetrically, how to get clean creases, the differences between mountain, valley, and universal folds), having them replicate an existing design caused some frustration.

Wasting time may be seen initially as a negative aspect of modeling. Most students are trained to be efficient in their learning and project production style\textsuperscript{112}, which may be detrimental to learning. However, wasting time - or what we might call “forging time” - is the goal here. “As with all creative endeavors, I think time spent visualizing and experimenting is not a waste of time because that is how ideas are generated.”\textsuperscript{113} There is an important difference in how this student validates this “waste of time” as an opportunity to gain something valuable.

There is no single one-size-fits-all procedure - especially in the making realm. All forms of idea-churning, brainstorm magic need to be considered open, and encouraged to students. Education should veer towards a personalized experience. Some students are admittedly more comfortable with sketching, evident in their submissions that include pictures of personal sketchbooks. These students chose to write notes from class and sketch designs first, perhaps for their reference or to help them understand the concepts better. Not all students will find this type of modeling as beneficial as something like

\textsuperscript{111} Anonymous Student, in written response to the Author, September 2020.
\textsuperscript{113} Anonymous Student, in written response to the Author, September 2020.
sketching, and some students would consider sketching as a type of modeling and idea processing tool. Instead of discounting the valuable tool of sketching, educators should recognize everyone’s process as valuable to how they see and process design and ideas.

To summarize, it is important to think of the model as a process rather than only as a tool for final representation of a completed design. Therefore, there needs to be room for experimentation, and what we might call “trial-and-trial” rather than trial-and-error. While some students may be more drawn to craftsmanship or burdened with perfectionism, this experimentation can lead to new creative inputs into the design process and free model time should be encouraged.

Material and Representation

The type of materials that are used in making-based exercises are important. For instance, several students commented on the importance of affordable and “non-precious” materials. Experimenting requires more paper rather than chipboard, or more clay rather than wood. One sophomore student commented on the importance of paper as an art medium – “The use of paper in art is very common and it is easily accessible and flexible.”\textsuperscript{114} Through their exercise, sophomore students understood the structural qualities of paper better. The fact that most students had access to paper at home was very helpful and allowed students to feel a bit more comfortable with making a wrong move, tossing something out, being a little bolder with experimenting and “wasting material.” Paper is one of the more acceptable options for quick and dirty modeling.

Senior students also gravitated towards cheap, accessible, plentiful, and recyclable household materials in addition to their model kit materials. One student

\textsuperscript{114} Anonymous Student, in written response to the Author, September 2020.
“used two materials, clay and paper to represent the blocks and open space.”

Using a few distinguishable materials within a singular model helps us assign very basic forms to the site. By modeling these elements with simple materials like clay and paper, students can digest the idea of iterating more easily.

Perhaps the most abrupt change in material is the movement from the physical model to digital three-dimensional modeling. Nonetheless, there is much benefit to traffic between the two. For instance, with Model Study Two, most students commented that having first built a physical model of a site made it much easier to model in a digital space. This seemed to operate almost as a recollection of the process of constructing the physical model as it is translated through digital commands. “Creating a Rhino model was surprisingly easy since I had the physical models to create general dimensions and proportions.”

Through this translation to digital process, and through the rest of the design process, the models become references to look back on – almost like a form journal, making changes in form over time. However, nobody mentions going back to the physical model after the digital model is completed. This makes the digital model feel a bit like a “be all end all” when it comes to the design of the site. One student explained that they were confused about Model Study Three, the “play” study, in class discussion: “Maybe I did too much on my model in Rhino already that I didn't know what to do.”

On the other hand, adding more digital tools was overwhelming to most senior students. Model Study Four, where students started using Grasshopper, was the most intense of all studies with the longest directions. The software is something the students have barely been introduced to, but the goal of this study is to gently introduce the

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program to them. In the discussion, every student thought that the training in Grasshopper was inadequate.

Grasshopper was hard for me to understand and learn with the scripts and calculations. It's probably something that I would like using if I had more familiarity with the program - could be something to focus on learning over winter break.\textsuperscript{118}

If Grasshopper helped these students with anything, it certainly played a role in thinking about texture and materiality. Students mentioned that applying facades and form with Grasshopper allowed them to think about how water might flow over a certain material, or how their object would look like or be used dependent on the material. However, this would also be achieved with other tools, like collaging.

For the students, there is a constant drive towards the completion of a model for rendering and presentation purposes. It is apparent that the industry standard is digital rendering, which is valuable in many ways. However, physical models are a bit more forgiving in the way that they allow for freedom of manipulation and action. There is no need to train for many hours and know command sequences that a digital model may require.\textsuperscript{119} What physical models may not offer is the expected representational quality that students and instructors are looking for. Digital graphic editors, like Photoshop, are a valuable addition to the physical model. This can help achieve a complex and beautiful hybrid representation, as discussed in Nadia Amoroso’s \textit{Representing Landscapes Hybrid}.\textsuperscript{120} There is also the option of experimentation with imagery and colors that convey what cannot be expressed through the physical model. Collaging techniques allow students to advance their models to develop more comprehensive conceptual ideas while exploring their own style in form and graphics.

\textsuperscript{118} Anonymous Student, in written response to the Author, November 2020.
\textsuperscript{119} Hurkxkens and Munkel, “Speculative Precision: Combining Haptic Terrain Modelling with Real-Time Digital Analysis for Landscape Design,” 399.
\textsuperscript{120} Cooper, “Review of \textit{Representing Landscapes: Hybrid} by Nadia Amoroso.”
Toolbox Addition

As students reflect on their obstacles in this process, it is also beneficial for them to recognize their triumphs. One student reflects on their finished model: “I was impressed with my finished product. At first, I was frustrated because I wasn’t getting it, but it later became satisfying. I learned to endure and not give up so easily. I also learned how to fold.”121 It is necessary for students to express their impressions of their models. It is a satisfying feeling to be finished with something, and even though a design can always be improved, it is important to appreciate the steps along the way and admire them as finished objects. This improves students’ self-esteem and personal motivation to keep going - not only in their project, but in their schooling and their daily lives.

While students are motivated by various factors, interviews revealed that grades are a consistent concern. That is, perhaps, the biggest motivation for several students. One student writes: “With my hobby of painting, I am more open to learning and trying new methods. However, since this is graded, my number one priority was to just get it right and complete it.”122 The most important lesson to learn is that since this is a graded assignment, there is a pressure to get it done and done correctly. If it were not graded, the case may be different.

Every exercise should add to one’s “design toolbox,” helping students learn in the moment, but providing future benefits as well. Students recognize that learning a new skill does take some time but is valuable. Although some students may have a harder time than others with completing certain tasks, this knowledge can be used by the instructor or student to build an appropriate future design toolkit.

Conclusion

Through these lessons, students emphasized the need and appreciation for active rest within the design process. We often hear about active rest as a physical activity, in terms of letting our bodies recover after an intense workout while still moving instead of being stagnant.123 This is important in mental activities as well. Active rest in design is essential for continued movement towards final goals, especially in a highly intense, timed process such as a landscape architectural design studio.

The making exercises allowed the students to embrace play as a tool for creativity. By bringing in prior expertise as a tool for making within design processes, students can engage with their own histories, passions, and interests. This encourages an enriching and diverse environment. By providing collaborative space for students to work on making projects together, communication, shared frustration, and encouraging friendships become valuable resources for students in the exploration stages of the design process.

The model becomes a “frozen moment of process”124 for students and starts to emphasize the value of the process over the finished representation of the design itself. In this method experimentation is allowed, craftsmanship and perfectionism are set aside for focus on the experimentation stage, and different modes of exploration are encouraged. “Free model time” encourages students to embrace this playfulness, to be okay with “wasting time” (or “forging time”) and works to keep the iterative swinging

124 James Melsom (Lecturer at University of Technology Sydney) in discussion with the author, January 27, 2021.
momentum alive in an environment where the final representation is often pushed hard from the beginning.

Making brings to light the importance of material as concepts are explored and helps in the exploration of scale in different ways through material choices. Modeling and making can be used as tools to highlight the role of analog and digital processes playing off one another. Using analog and digital models in collaging processes embraces the analog/digital mixture, bringing depth and meaning to a model. New perspectives, representations, materials, and processes provide excitement about the process and drive the design forward.

Lastly, we must remember the goals of the instructor and the goals of the student in this process. Despite encouraging play and experimentation, students may feel that it all comes down to the gradebook. Despite this mindset, students can bring skills they learn through their making process into other studios and areas of their life as a “toolbox addition.” The conclusion chapter will start to move towards recommendations of encouraging the role of these exercises as toolbox additions, emphasizing learning over the final grade.

The next chapter shifts from an analysis of the students’ experiences and perspective to provide resources and guidance for educators and students to use a making-based approach in design studios. These recommendations come from the standpoint of the student - I am not an educator nor do I have a degree in education or pedagogical structure, though I do have firsthand experience of being a student in a design studio and investigating other interactions of students in design studios.

The knowledge gained from this thesis study will be featured in a website that will be available to the public. This implementation for highlighting guidelines for a making-based approach will provide a resource that brings together scholarly research, experiment notes and ideas, as well as creativity generators in the form of zine and
website. I hope that these ideas can be used to bring a stronger making-based approach to landscape architecture design studio courses. Students will also be able to access this website and choose strategies that might benefit their own processes. In this way, the website will act as a reference tool and an active creativity tool.

In this way I hope to humbly offer an opportunity for a shift in emphasis from the beautiful representation to a productive model that places emphasis on process, detail, and individuality in the design process. And that perhaps even works to introduce joy - which is often in short supply in the studio space.
**Interlude III: Making Rest**

On another note: something I notice in my work is that I love to start it, but I have a hard time finishing it. What are the roadblocks stopping this? Is it tedious action? Once you figure out the process, is the work done? Do you need to carry it out? I question a lot of these sentiments now: Does the imposition of a quarantine make me lazy, or just lacking creativity somehow? Am I just completing one singular part of the creativity and making process? I think there's something that I'm realizing, which is making can be done probably anywhere, with anything, but having a variety of places, people, experiences, and constant movement in life is a supplement that energizes making, or that catalyzes, amplifies, and informs making. Making is a reflection of not just the work you are doing, but every technique, material, and choice you make in the process is a reflection of yourself too. I'm not just making lesson plans here; I'm not just trying to justify different methods of visualization and communication – I'm also making art. And making art is sometimes a temporal mystery.

The making break I took was extremely healthy and much needed. We need to remind ourselves that resting, sitting, sleeping, thinking, dreaming is working without any visible body movement at all. I tend to be in a bit of a fight with myself – I need to submit, submit, submit, but have a hard time getting up the will to really work on things when there's too much crowding in the to do list. Smaller lists and easier actions ease that. A little bit at a time is effective but doesn't seem like it from the get-go. And forcing myself to remind myself that I have done a lot of work, which is valid, is especially important in this time when it feels like productivity levels are low. It just amps me up to keep going and exploring!

What are the implications of this project when people leave the educational realm? When firms run on budgets, and efficiency? I hope this project helps people to find fun, comfort, relaxation, and balance in their work life. To realize that not everything needs to be taken so seriously or ridden with anxiety or a constant pressure. Making design, making art, making free time, making in general can be a huge action of protest or resistance, while still seeming like a small act of folding paper.
Figure 29: Rhino drawings laser etched into acrylic ink exploration, 11x17. Created by author. March 2020.
Chapter 4: Recommendations for a Making-Based Curriculum

The making-based approach investigated in Fall Semester 2020 studio classes emphasized the need and appreciation for active rest within the design process from the students’ perspective. Students were able to embrace play as a tool for creativity; bring in their expertise, histories, passions, and interests. Exploring their own design process, students learned landscape architectural and material qualities of their models and sites - putting emphasis on process over product. From the perspective of an educator, this is a response and adaptation to the rapidly changing goals and curriculum standards of landscape architecture in North America. A making-based approach allows landscape architecture programs to meet the important technical requirements and knowledge base that future landscape architects need. At the same time, it can enable ethical studio practices that affect students both inside and outside the design studio process.

The ASLA (American Society of Landscape Architects) and LAAB (Landscape Architectural Accreditation Board) define extensive standards and procedures for accreditation of American landscape architecture programs, but do not concretely address studio culture. This information is updated at least every five years, and goes through an extensive process including overview from representatives of ASLA, CELA (The Council of Educators in Landscape Architecture), and CLARB (The Council of Landscape Architectural Registration Boards), as well as landscape architecture educators, landscape architecture practitioners, and representatives of the public.126 However, schools have the ability to stay relatively autonomous in teaching methods and

126 “Accreditation Procedures for Professional Programs in Landscape Architecture,” 1.
direction, as long as they meet these technical standards. While this variety keeps the field interesting and exciting - and allows for different focuses in a multidisciplinary field - a lack of discussion about studio culture practices and educational training leads to the persistence and stagnation of outdated, unethical studio practices that are not reviewed or disciplined by this accreditation board.

We can ensure that a making-based approach still works to help students attain technical landscape architectural knowledge and education by testing the exercises within the studio and beginning to integrate a making-forward structure within the studio. The making-based approach, as explored in this thesis through interviews, in-class experimentations, and personal making studies, effectively allows students to embrace the technical concepts needed for the LARE (Landscape Architect Registration Examination) through experiential learning. While a variety of different curriculum styles may help students attain technical knowledge, the making-based approach may be preferred by the student. Being open minded and exposing students to a making-based approach may allow students to select design methods that work best for them in conceptual and detail-oriented thinking.

What the making-based approach highlights that other curricula may not explicitly offer is a framework that can affect the social and cultural aspects of studio culture, both in the educational and professional realms. Evidence stemming from interviews, personal experience, shared anecdotes, and the rapid expansion of memes through various social media platforms dedicated to design students and professionals, draw attention to unethical and toxic studio culture environments. We cannot measure the effectiveness of an ethical studio environment on a student’s work ethic as easily as the

127 Dr. Wolfram Hoefer (Associate Professor at Rutgers University Department of Landscape Architecture) in discussion with the author, February 22, 2021.
technical knowledge part of the curriculum. Nonetheless, it is incredibly important for student learning and professional development.

The design process reviewed in the first chapter underlines the benefits of a making-based approach. Kathryn Gustafson’s design process starts with a clay topographical formation, which is digitally scanned and translated into digital modeling software, keeping the model central to her approach. This illustrates a non-hierarchical use of digital modeling and physical modeling working jointly throughout the design process. At SITU, designers start with thinking about optimal construction approaches for the design at hand. Beginning with physical model studies, next a 3D model becomes the critical tool for fabrication and construction. SITU’s flexible and iterative approach keeps the model central to process.

Literature discussed in the first chapter further foregrounds the value of a making-based approach. Nadia Amoroso discusses the visualization method of hybrid techniques. By combining existing techniques, hybrid techniques can communicate ideas in different ways to other designers, clients, students, and educators. Mike Kelley’s Education Complex questions the role of a model as an idea communicator and a creativity engine. It brings into light that the model can communicate both objective and subjective messages. Megan Lotts’ “Floating castles, Legos, Candy, and Play: Counterplay 2016” recounts experiencing play as a tool that highlights being present, adaptive, and productive in a team-building setting. These precedents all play a role in creating a framework for the making-based approach.

131 Cooper, “Review of Representing Landscapes: Hybrid by Nadia Amoroso.”
132 Moon, “Review of Mike Kelley: Educational Complex by John Miller.”
In this Conclusion Chapter I synthesize all aspects of my research and draw some recommendations for implementing a making-based approach. I discuss below recommendations for educators and students for a making-based approach. An interactive website and zine, the final deliverables created for this project, are used to communicate this information in a public-facing platform. These resources can be used by students and educators to gain more familiarity with including making-based techniques in their design and teaching process.

This chapter details the outcomes of this extensive research, explaining how users can interact with the Making Design website and Creativity Zine. It concludes with aspirations for the making-based approach and areas of further required research.

**Making Design Website and Creativity Zine**

The main deliverable of this investigation is a website that serves as a resource for educators and students. “Making Design” (http://makingdesign.xyz/) contains a summary of my research and examples of making, an annotated bibliography of collected scholarly research, and tools for educators and students to actively make. These tools include a make-your-own “Creativity Zine”, detailing guidelines and prompts for making, as well as an interactive “Idea Generator”. The website is organized into three sections: Research, Experience, and Create. Recognizing that making is a process that is iterative, that has many “back and forths”, and that switches registers between the analog and the digital, this website is intended to be explored in a non-linear fashion by the user.

The Making Design website invites students in search of step-by-step guides, researchers investigating sources, or instructors looking for teaching ideas. This website is open to anyone and everyone – to engage in making. “Making Culture” emphasizes
creation, collaboration, and individual agency (control, autonomy, and choice) in learning. This experience is designed to uphold the essence of “Making Culture;” and while it is directed to students, educators, and researchers, it is all-embracing.

Figure 30: Making Design website, home page. Illustration by author.

When visitors first land on the website, they are met with a brain graphic that links all parts of the website in a web-like diagram. The introductory graphic represents a brain because the user makes a move on the website and something unexpected happens - the blobs wiggle like jelly and change color. The brain structure of subjects grouped loosely around the central Making Design home removes hierarchy and mirrors the non-linear thought process in design practice. The blue, green, and pink blobs symbolize a rough grouping of the subjects into the Research, Experience, or Create categories, but these categories do leak into each other, and start to blur lines of distinction. Visitors can explore this page by clicking on the topics inside the brain,

exploring in a non-linear way, or by accessing the more structured drop-down menu in the top-left corner.

Figure 32: Making Design website, home page movement. Illustration by author.

Figure 31: Making Design website, home page movement. Illustration by author.
The “Research” section offers a collection of existing scholarly research with an annotated bibliography, as well as material from interviews with students and educators conducted as a part of this thesis. The section offers sources discussed and referenced within this paper and the website as easily accessible links, along with a summary of the information as it relates to the “making-based approach.” Anonymized quotes from the interview process for this project are also housed in this section, as anecdotal information from students and educators became increasingly important to reflect on the personal observation of current studio practices and their effectiveness. Visitors may use this page to access a collection of existing research and anecdotal information for further reading.

The “Experience” section houses information of the design studio experiments and my personal makings, as implementations of the making-based approach. Descriptions of the studio experiments, as well as results and findings, guide the reader through examples of implemented making-based design. My personal “makings” detail my own experience with making during the process of this project, as well as reflections
on those “makings.” In this section, readers will gain an understanding of what a making-based approach can look like. From here they might gain inspiration for their own personal making. Examples include topics of mixing materials, thinking logistically with 3D printing, machining handmade artwork, and transferring a model to analog and digital spaces iteratively. These examples are not step-by-step instructions, but rather offer inspiration for hybridization methods in making. There is an emphasis on the material, tool, and process, which has more value than the end product.

The “Create” section is the most interactive section on the website, providing resources for making including an idea generator, curated resources for specific making processes, and the Creativity Zine. The idea generator is an online tool embedded in the website that gives the user suggestions for a “material”, “tool”, and “prompt” for making something. Users can click through options and challenge themselves to try and play
Click "Generate" to generate a material, a tool, and an idea to put it all together.

With some yarn, using some sticks, imagine your favorite place and make something that you can hang up!

Figure 35: Making Design website, Creativity Generator. Illustration by author. Code by Jared Tulayan.

with the given random combinations or pick a singular parameter to follow while making something. Users can also access the “curated resources” page, which has a collection of external links that detail technical information about making. These technical guides curate open-source information from a plethora of makers on things like “how to make a Rhino model 3D printable” or “how to convert artwork to embroidery.” This step-by-step information further encourages inspiration for readers and enhances accessibility to different machines and materials. The “Create” section is also home to the Creativity Zine, a downloadable, make-it-yourself publication that I created to inspire different forms of creativity through making.
The Creativity Zine is a free and accessible publication that anyone can print from home. The publication invites readers to cut and fold the zine, and to use it to suit their needs in the making process. Highlighting lessons from the “personal making” section of the website, users are prompted with directives to create something. Some of these directives include, “mix material,” “waste time,” and “apply skills.” This zine is a product of play and experimentation, and users are encouraged to interact with the publication playfully.
Figure 37: Creativity Zine. Photos by author.
Figure 38: Creativity Zine, template diagrams. Illustrations by author.
Figure 39: Creativity Zine, template diagrams. Illustrations by author.
This zine is a product of play and experimentation. Inside, you will find a series of prompts that resulted from my own experience with making and creativity, which were also used to make this zine. These prompts raise questions, highlight focus points, and give examples for design students within their making experience and design process. Relax and have fun making your own Making Creativity zine with cutting and folding the paper. Feel free to fold it the wrong way, share it, rip it up, keep it in your pocket, color it, make notes or sketches, or glue pictures in it.

**Mix Materials**

Take two unsuspecting materials and mash them together. The materials can be found in an old box in your room, outside, in an unclaimed lost and found bucket, in the clearance section of the craft store, or online. How can you make them interact? What techniques are involved in this interaction? Focus on your construction techniques involved in the making process. Focus on your expected final form. Focus on how you solve the new challenge you've given yourself.

Figure 40: Creativity Zine, introduction. Illustration by author.

Figure 41: Creativity Zine, mix materials section. Illustration by author.
I plan to keep adding resources as accessible modeling techniques and technology advance over time. The products of this project will never have a final state. As I continue to learn about a making-based approach in my own practice and from others, the website will be updated. I intend for this to serve as a database of references that will be current and relevant, but also documentation of growth and process.
Conclusion

I hope the implementation of the Making Design website and Creativity Zine will allow the making-based approach to be accessible and valuable to educators and students. Through a non-linear explorative approach, a playful interaction with the website and zine encourages fun in the process of learning and practicing a making-based approach. Creating a space for continually collecting information and reflecting on Making Design highlights the value of process over product.

This website will be launched by the time this paper is submitted and will continue to grow and change. As I work with computer science major Jared Tulayan on making the site a reality, it will adapt to technological needs as needed. I plan on publicizing the site through social media platforms as a starting point. Instagram stories, which can be easily shared, are a rather fast method of distribution. Landscape architecture meme pages, like @TheLandscapeofMemes, are ideal for promotion. In an academic sense, I hope to submit this project, along with the website and zine, to the CELA 2022 Annual Conference. I think this work will be appreciated in this academic setting of landscape architecture students and educators.

The introduction of making-based practices in landscape architectural education encourages student growth and self-agency through the design process. It can bring a change not only in individual design processes, but to the atmosphere of design studio classes and to studio culture more broadly. This can shift into a larger scale, affecting studio culture in the professional environment. The making-based approach benefits the student immediately, but as students enters the professional environment, they bring their design process and values with them.

The work on Making Design and the making-based approach is not finished. Alternative studio frameworks still require research, including more reviews of higher education studio practices across the country and world. Investigating studio practices from the perspective of professionals can help inform educational practices. Lastly, quantitative studies on the effect of making-based design on a student’s creativity or success would provide a scientific lens on the making-based approach.

Like Gustafson’s clay models, SITU’s fabrication approach, the playful surface of the LEGO table, or my own personal makings, the making-based approach proposed here is still in process. It will change as it moves through studios, and as it is translated back and forth from analog to digital and back. And of course, it will take shape in different hands.

I hope that this project will help cultivate a landscape architecture curriculum and design studio culture that emphasizes student interests and skills through a making-based approach. There is a recognition that the studio space is a place for celebration of differing background identities, places, and cultures. A making-forward framework allows for flexibility to respond to student interests - establishing a relationship where educators and students are more responsive to each other. What I have loved about my landscape architecture education is the celebration of diversity in the studio, and the variety of processes that stem from this. Incorporating a making-based approach can work towards breaking the cycle of an institutionalized studio culture.
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