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At the intersection of space, place, and experience: An ethnographic case study of affordances in Architectural Design 1

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At the intersection of space, place, and experience:

An ethnographic case study of affordances in Architectural Design 1

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The student author and the program of study committee are solely responsible for the content of this dissertation. The Graduate College will ensure this dissertation is globally accessible and will not permit alterations after a degree is conferred.

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ABSTRACT

This ethnographic case study explored the learning environment of a studio design course to describe how interactions in the studio environment shape students' understandings and behaviors as they learn the fundamental elements of design and architectural practice. The purpose of the study was to understand the role of the studio environment in supporting students' architectural knowledge and identity and provide insight into how individual-environment interactions shape how students make meaning of their learning experiences. I spent a semester as a participant-observer in a beginning architecture course at a large, public university, and gathered data through approximately 106 hours of studio observations, 39 in-depth interviews, course-related artifacts, and reflections on studio visits. Using a conceptual framework of affordances (Gibson, 1979; Greeno 1994), I describe the various ways the studio environment creates opportunities for social interaction and how studio culture intersects with the affordances of the studio environment.

The study revealed the physical affordances of the studio environment were the open layout, public/private workspaces, and co-working in proximity to others. The structural affordances were long blocks of unscheduled work time, alignment between studio and other courses in the curriculum, the project brief, and the sequencing of the projects, tasks, and deadlines. The pedagogical affordances were formal and informal critique, mini-lectures, and demonstrations. Four characteristics of studio culture as defined by the literature—(a) a community of learners and architects; (b) centralizing feedback; (c) untimetabled design activity; and (d) experimentation and risk-taking—intersected with the physical, structural, and physical affordances of the studio in how beginning architecture students made meaning

of their learning. Based on the findings of this study, implications were offered for architecture and design educators, faculty interested in adopting studio learning environments in non-design fields, and future research on studio learning environments.

CHAPTER 1. INTRODUCTION

This ethnographic case study was conducted to provide a thick, rich description of the learning environment of a studio course, and explore how interactions in this environment shape students' understandings and behaviors as they learn the fundamental elements of design and architectural practice. Data for this study were gathered from the semester I spent as a participant-observer in Architecture Design 1, a beginning architecture course in a college of design at a large, public university. Using a conceptual framework of affordances (Gibson, 1979; Greeno 1994), I describe the various ways the studio environment creates opportunities for social interaction, and how studio culture intersects with the affordances of the studio environment in how students make meaning of their learning. The knowledge generated from this study may be used to help others understand the role of the studio environment in supporting students' architectural knowledge and identity, and provide insight into how individual-environment interactions shape how students make meaning of their learning experiences.

Background and Context

More than 30 years ago, Donald Schön (1983, 1985) positioned the architecture studio as a model for learning and development in the professions (Cennamo & Brandt, 2012). Schön proposed that all educational disciplines could enhance learning through learning-by-doing and reflection-in-action as represented in architecture education. Through learning activities that emulate practice, students learn to think and perform like professional architects in the field. Since Schön, studio-based learning environments have been adapted for use in other disciplines such as mathematics (Cossentino & David Williamson, 1999),

science (Fortus, Dershimer, Krajcik, Marx, & Mamlok-Naaman, 2004; Kolodner et al., 2003), instructional technology (Clinton & Rieber, 2010), engineering (Little & Cardenas, 2001), and computer science (Wilson & Jennings, 2000).

However, while previous research has identified the elements of the studio environment in architecture education and how these elements work together to contribute to the development of architectural knowledge and professional expertise, few studies have explored these interactions through immersive studies of actual studio practice. This ethnographic case study richly describes the learning environment of a studio course to explore how interactions in the studio environment shape students' understandings and behaviors as they learn the fundamental elements of design and architectural practice.

The Studio as a Learning Environment

As traditionally applied in design fields like architecture, the studio is simultaneously as *space*, *class*, and a *pedagogical method* (Brandt et al., 2013; Cennamo & Brandt, 2012). The studio also has a particular *culture*, or the network of experiences, habits, and patterns that support or constrain learning (Dutton, 1991; Ward, 1990). Each of these conceptualizations—space, class, pedagogy, and culture—is referenced in this exploration of the learning environment of the "studio".

Physical space

The studio space is composed of individual, dedicated desk spaces where students are encouraged to work, even outside of class hours. Students' working together at individual desks in shared space is seen as a key feature of the studio environment (Lawson & Dorst, 2009). Studios are used by a single cohort of students for the entire semester, allowing for

the display of visual artifacts over an extended period. Students work on a single project over a long period, always visible at their desks, or pinned on the walls, or situated at tables where students meet to discuss work in progress (Cennamo & Brandt, 2012; Shaffer, 2003).

Colleges and universities have converted standard classroom spaces into "studio" classrooms through flexible seating and collaborative spaces. For example, Taylor (2009) described a studio classroom for science with movable furniture, and dedicated wall space for presenting ideas and work-in-progress. Taylor found that the adaptability, flexibility of the studio space supported complex strategies of collaboration and the flexibility to form teams based on their own perceived need for knowledge and expertise to complete collaborative assignments. Others have reported some benefits to opening the classroom space for dedicated use outside of class time. Arvola and Artman (2008) found that for students in human-computer interaction (HCI) the lack of constant access to a space limited peer collaboration and constrained students' abilities to rely on each other as resources, or test design decisions prior to class. These informal, spontaneous interactions that occurred outside classroom time were important for progressing students' ideas forward (Cennamo & Brandt, 2012).

Class

The studio class is scheduled for long blocks of time, several times per week. These unrestricted time tables allow for lessons and demonstrations as well as for free design activity (Lawson & Dorst, 2009). The large, unscheduled blocks of time for design activity requires that students learn to self-regulate and manage their time and pace of production. The percentage of students' time in the curriculum that is devoted to studio work gives the

studio precedence over other academic and non-studio classes (Cennamo & Brandt, 2012; Cox, Harrison, & Hoadley, 2008).

Less evidence in the literature exists of classes that have long hours like a studio model outside of design due to the logistic difficulties of incorporating studio courses into an existing curriculum. However, the instructional design studio (IDD) described by Clinton and Reiber (2010) is an example of how a conventional course was converted into a studio course, focusing on developing design expertise through projects that mimic professional practice, and students working in co-located, public space. Students in this environment learned through self-study and feedback from peers, advanced students were expected to help and coach novice students, and assessments were made public. Although the class did not meet in extended blocks of time, students identified being "in studio" and created a learning culture where the end product was more important the content and methods being taught (Clinton & Rieber).

Pedagogy

The *pedagogy* of the studio is composed of project-based assignments followed by public critique of students' work for critique (Cennamo & Brandt, 2012). Students are presented with a design project that is situated in authentic, real-world practice, and are expected to work individually or in groups to solve the design "problem" (Cennamo & Brandt). Although projects are open-ended, they are also specified by a set of parameters or constraints that restrict how the student can proceed. The constraints serve many purposes by limiting students' creative options or help them to avoid falling into familiar problem solving patterns; constraints also help students to slow down, and reflect on decision-making

processes and consider revisions (Sawyer, 2012). Design projects are also designed to be sequential; that is, each assignment is carefully sequenced so that desired techniques and architectural knowledge are acquired and moves students to the next phase of the design process (Sawyer).

At various points throughout the semester, students are expected to present their in-process design solutions to their instructors, peers, and other guests in critiques that encourage students' reflection on their design process. Reflective discussion in the studio is always focused on the students' designed object with the intention to guide students toward the ability to link their intention with the designed object (Sawyer, 2012). Visual artifacts, such as drawings, models, make the thinking and understanding in the design process visible to others. Students are expected to reflect upon the feedback they received during critiques and use it to inform future iterations of the design (Cennamo & Brandt, 2012).

Culture

The architecture studio also has its own *culture* and values that are influential to a students' development of architectural knowledge and professional identity. In many ways, the beliefs, values, and habits of mind cultivated in the architecture studio are intentional by-products of the combination of space and pedagogy, for instance, the understanding that design is an iterative process. The studio culture can support positive learning practices as well as constrain or afford negative ones. Many scholars have brought attention to the "hidden curriculum" (Anthony, 1987; Blair, 2006; Dutton, 1991; Webster, 2006b) of studio learning, or the tacit values, attitudes, norms that stem from the social interactions in the studio space, curriculum, and pedagogy. Many aspects of architectural studio culture

specifically have a history of favoring Eurocentrism, cultural chauvinism, individualism, hierarchy, and patriarchy (Anthony, 1987; Bell, 2015; Webster, 2006b). Calls for change have focused on creating studio cultures that support student agency, work-life balance and flexibility, diverse social and cultural contexts, and peer learning (Lawson & Dorst, 2009; Yanar, 2007).

Learning

Today, the focus of a designer's training still follows the tradition built around the tenets of apprenticeship-based learning through a series of open-ended, progressively challenging tasks, and a variety of structured conversations around the public display of student work in a studio setting (Lawson & Dorst, 2009). Nevertheless, only a few studies have shown how the distinctiveness of studio pedagogies helps students build their design knowledge and transition to the profession. For example, the use of space in the studio for "shared, prolonged, communal activity" (Shreeve, Sims, & Trowler, 2010, p. 133) is "fundamental to students' engagement in design practices and learning how to 'do' design" (Morton, 2011, p. 102). The role of material artifacts, namely the interaction with media and renderings as a tool for meaning-making, creates "a dialogue with materials in a process of discovery" (Morton, p. 102). As Morton states, the physical setting and role of material artifacts and the development of shared, common language have been shown to be fundamental to the link between academia and the professional work place.

Another central tenant of studio pedagogy is the critical review of students' work in a semi-public or public setting. This model of critical review has been central to formal design training architectural training since the beginning, and has been identified as the signature

pedagogy (Shulman, 2005) through which students develop critical and linguistic skills that are integral to the architectural profession. Students are provided multiple opportunities for feedback on their design performance through "desk crits", "pin ups" or group reviews, mid-term and final reviews that range from individual to public, and informal to formal settings (Oh, Ishizaki, Gross, & Yi-Luen Do, 2013). Critiques serve an important professionalization tool where students learn, through feedback, about fundamental concepts of design practice as well as the norms of design interaction (Dannels, Housley Gaffney, & Martin, 2011).

The cycle of learning-by-doing and reflection-in-action (Lawson, 2004; Lawson & Dorst, 2009; Schön, 1985) has been viewed as the heart of the iterative design process, in which problems are framed and reframed repeatedly in a generative process. A problem is first 'framed', that is, structures of belief, perception, and appreciation which underlie the problem, a form of 'seeing as' (Lawson & Dorst, 2009; Schön, 1985). Then actions are taken, a performance or series of 'moves' toward a solution. Strengths and weaknesses of the position are evaluated, often in a public setting with feedback from others, and based on this 'evaluation' new actions or frames may be created (Cross, 1982, 2001; Lawson & Dorst, 2009; Schön, 1983, 1985).

The studio is a complex learning environment—simultaneously a space, a class and a pedagogy that houses a system of activities which support or constrain students' understanding of knowledge and practice. These aspects are mediated by a studio culture, or a set of norms, values and traditions that influence how learners interact in the studio environment. Although the physical features and the pedagogy of the studio have been well-documented, relatively little attention has been paid to students' learning and development in the studio environment through an ecological lens. The current study sought to identify how

students make meaning of their architectural knowledge through interactions with the objects, people, and events within the context of one studio course.

Research Purpose and Questions

This ethnographic case study attempted to richly describe the learning environment of a studio course to explore how interactions in the studio environment shape students' understandings and behaviors as they learn the fundamental elements of architectural practice. My assumption was that students assign different meanings to the objects, events, and social interactions in a studio environment, and studio culture intersects with how students make meaning of these interactions, thus shaping their understandings of the practice of architecture.

Because the studio environment encompasses many different, concurring interactions, I used an ecological lens to focus my case-based inquiry on two main research questions:

1. What are the physical, structural, and pedagogical affordances of the studio learning environment in Architectural Design 1; and
2. In what ways do characteristics of studio culture intersect with the affordances of Architectural Design 1 in how students make meaning of their architectural learning and development as architectural professionals?

Rationale

This research was necessary for several reasons. First, the studio is the primary means by which architecture students learn architectural knowledge and practice, but there has been a paucity of literature that explores the studio environment from an ecological perspective. A number of studies have explored specific aspects of design pedagogy (Arvola

& Artman, 2008; Brown, 2006; Casakin & Kreitler, 2008; Cox et al., 2008; Little & Cardenas, 2001; Reimer & Douglas, 2003; Taylor, 2009; Wilson & Jennings, 2000) or the social or epistemological implications of studio practices (Bell, 2015; Bull & Whittle, 2014; Casakin, 2011, 2012; Cennamo & Brandt, 2012; Gray, 2013; Mewburn, 2011; Uluoğlu, 2000; Yanar, 2007). Nevertheless, there has been little research conducted to examine the complex ecology of the studio environment—the physical space, structure, and pedagogy of the architectural studio—and how it enables social activities and interactions that contribute to students' learning and development. On a basic level, the goal of this case study was conducted to richly describe the ways in which these elements of the studio support or constrain how students' make meaning of architectural knowledge and practice in one studio environment.

In addition, while new frameworks and research on learner-centered environments and pedagogical approaches have advanced learning across many disciplines over the last two decades, the results of this research have been slow to make its way into architectural education (Bell, 2015; Jonassen & Land, 2012). Many design faculty come from professional practice and, as such, few educators have had formal training in pedagogy and curricular design. Moore (2001) pointed out that pedagogical or curricular discussions are not very common in design schools. Only recently design and architecture educators have begun to discuss how pedagogy, curricula, and learning resources enable students to acquire knowledge and how this knowledge will be useful over a life-time of practice (Boyer, 1996; Moore). By better understanding the role of the learning environment and social interactions in shaping students' understandings, the goal of this research was to describe the ways the

studio environment enables social interaction, and, more specifically, how studio culture mediates interpretations of actions within one studio environment.

Finally, studio-based learning environments have been adapted for use in non-design disciplines (Cossentino & Williamson, 1999; Fortus et al., 2004; Kolodner et al., 2003). Traditionally, studios use many campus and faculty resources, requiring dedicated physical space, large blocks of time within a students' course of study, and extensive faculty contact time (Cennamo & Brandt, 2012; Lawson & Dorst, 2009). As a result, traditional non-studio disciplines find it difficult to support all of the features found in conventional studio-based disciplines like architecture (Brandt et al., 2013; Cennamo & Brandt, 2012). The intent of this research was to richly describe how physical space, structure, pedagogy, and culture interact in a complex ecology to shape students' understanding of the knowledge and practices of their discipline.

Conceptual Framework

To explore how interactions in the studio environment shape students' understandings and behaviors, I initially drew upon the concept of *affordances*, or the reciprocal relationship between an individual and their environment that enables interaction (Gibson, 1977; Greeno, 1994). Gibson (1977, 2014) defined affordances as the possibility for action formed by the relationship between an individual and their environment; "the affordances of the environment are what it offers the animal, what is provides or furnishes, either for good or ill" (1979, p. 127). Greeno (1994) extended Gibson's concept of affordances through the lens of situation theory, and further defined an affordance as the qualitative features of the environment that contribute to social interactions. In this study I explored the physical and

pedagogical features, and the affordances or constraints they offered the students, in one architectural studio course.

Secondly, the studio as a learning environment has a long history in architectural education, and as such, has a distinct set of social normalities and regularities. These social norms are laden with meaning, and with them come "attentional commonalities that mediate the perception, qualification, and recognition" of the salience of an affordance, and possibility inhibit opportunities for action (Kauffman & Clement, 2007, p 24). Therefore, I also examined how studio culture intersected with the affordances of the architecture studio in how students make meaning of learning experiences in one architecture studio course.

Study Design

In fall semester of the 2015-16 school year, I conducted an ethnographic case study in an introductory architecture studio course, Architecture Design 1 (hereafter referred to as "AD 1") in a college of design at a large, public university in the United States. The studio is the core of the architecture degree, and the center of socialization of students, and the bridge between education and the architecture profession (Brandt et al., 2013; Morton, 2012; Morton & O'Brien, 2005); the goal of many architecture studio courses is to help young architects understand what it means to be a designer (Shaffer, 2003). Therefore, a first-year, first-semester architecture course provides an ideal context for richly describing how social interactions in, and the culture of, the studio shape students' understandings and behaviors as they learn the practice and profession of architecture.

Using an ethnographic approach (Esterberg, 2002; Fetterman, 2010), I recorded the experiences and perceptions of architecture students, purposefully selected as undergraduate,

bachelor degree-seeking students enrolled in their first year of a professional program in architecture, and their instructor, a faculty member in the department of architecture with a long history of teaching first-year architecture students.

"Getting in and gaining access"

Once I had determined the field setting for the research, I sought formal permission from college administrators to conduct the research. I also had the assistance of a faculty "gatekeeper" (Esterberg, 2002), Rebecca[1], who helped secure my access to the setting and acted as peer reviewer of the tentative findings and interpretations in this study.

I attended the first scheduled class session of AD 1 to make a verbal announcement about the research project to solicit participation (see Appendix A); I then returned to the course two days later and give participants the opportunity to self-select via an informed consent document (see Appendix B). More information on site selection, access, and participant recruitment can be found in Chapter 3.

Data collection

Field work observations, in-depth interviews with student and faculty participants, and my own reflections on studio visits were the primary methods of data collection used in this study. I conducted approximately 110 hours of observations in the AD 1 environment, resulting in approximately 280 pages of field notes on social interactions in the studio environment. I also conducted 39 semi-structured interviews with students and their

[1]All proper names in this study have been changed to pseudonyms, either assigned or chosen by the participants, to protect the participants' identities.

instructor, one interview per participant per month of the AD 1 course. The data obtained from the interviews were intended to gather data on participants' perceptions of the affordances of the learning environment, how they make meaning of these interactions, and their interpretations of studio culture. The unique perceptions and experiences of the participants in this study was a strength, as their uniqueness contributed to a variety of perspectives and themes that emerged in the analysis of the data (Merriam, 2012). Demographic information such as participants' geographic and educational background, age, gender, and ethnicity was also collected via participant interviews to provide insight into participants' previous knowledge and learning experiences.

After each studio visit, I recorded a visit "reflection" to capture my thoughts and insights on the visit, any emerging insights, and my assumptions, biases, and relationship to the study as it evolved. I recorded approximately 2 hours of studio reflections over the course of AD 1, which were transcribed and also used as data for this research study.

Course information, such as the syllabus and assignment handouts, and student-generated artifacts provided information on the learning context. Finally, an ongoing review of the literature provided a theoretical grounding for the study.

Data analysis

Coding categories for data analysis were developed and refined on an ongoing basis guided by the conceptual framework in this study. In addition, various strategies ensuring goodness and trustworthiness were employed, including: (1) taking data and tentative interpretations back to the participants to check for plausibility; (2) peer reviews with my methodologist and my gatekeeper regarding the process of the study and the congruency of

emerging findings; and (3) a detailed account of the methods, procedures, and decision points throughout the study (Merriam, 2002). More information about the research design and methodology can be found in Chapter 3.

Researcher Positionality

It is important to discuss my positionality as the researcher in this study through both insider (emic) and outsider (etic) perspectives (Creswell, 2013). I hold a bachelor's degree in visual arts and design, and a master's degree in arts administration and cultural policy. I also have 14 years of experience as a higher education administrator, including college admissions, academic advising, program management, and international affairs in colleges and schools of art and design. Thus, I brought my experience as a working professional to the inquiry, having both prior knowledge and understanding of the context of art and design in higher education. My positionality was shared with the participants in this study prior to their engagement in the research, and I feel strongly that this positionality was key to gaining access to the site, establishing the trust of the participants, and eventually becoming a member of the AD 1 community.

I acknowledge that my positionality could also serve as a liability, biasing my judgement on the research design and the interpretation of the findings. Foremost is the possibility that I, as the participant-observer in this ethnographic inquiry, would selectively attend to the details and interpretations that I hope to find in this study. I was committed to on-going critical self-reflection by way of continuous self-reflection, maintaining an audit trail and regular dialogue with professional colleagues and advisors. Moreover, to maintain my subjectivity and the credibility of the research, various methods of goodness and

trustworthiness were employed, such as triangulation of data collection, reviews with participants, and adequate engagement in data collection (Merriam, 2002). Ethical considerations and issues of goodness and trustworthiness are addressed in Chapter 3.

Definitions and Key Terminology

This section provides the definitions of key terminology used in this dissertation study. These terms are operationally defined or explained using definitions from the Oxford English Dictionary (2000), and sources from the literature on architecture, design, and education, as well as my own definitions of the terms within the context of this study.

Affordances: "Affordances" are the qualitative features of an environment that offers the individual an ability to socially interact (Gibson, 1979; Greeno, 1994). The concept of affordances will be described further in Chapter 2.

Architecture: The art or practice of designing buildings; the style in which a building is designed or constructed, especially in regard to a specific period, place or culture.

Architecture education: The process or structure by which architects receive their professional training at the college or university-level (NAAB, 2014).

Architecture knowledge: As this case study is situated within the context of architecture, "architecture knowledge" was defined by using the National Architecture Accreditation Board's (NAAB) student performance criteria (SPCs): (1) critical thinking and representation, (2) integrated building practices, technical skills and knowledge, (3) professional practice, and (4) integrated architectural solutions (NAAB, 2014). Within the context of a beginning course in a professional program of architecture, the learning is predominantly skill-based, and outcomes include professional communication skills, design

thinking skills, investigative skills, architectural design skills, ordering systems, and use of precedent.

Axonometric, *or "axon" drawing*: Using or designating an orthographic projection of an object, such as a building, on a plane inclined to each of the three principal axes of the object; three-dimensional but without perspective.

Critique: A critical review or commentary, especially one dealing with a literary or artistic work. Within the context of this study, "critique" is also the pedagogical method through which formative and summative feedback is given to students on their design performance. Critique can take various forms within architectural education, such as a "desk crit", a "pin up", a mid-term review, and a final review or jury, that range from individual to public, or informal to formal. Critique is defined further in Chapter 2.

Culture: Culture is "an historically transmitted pattern of meanings embodied in symbols, a system of inherited conceptions expressed in symbolic forms by means of which [people] communicate, perpetuate, and develop their knowledge about and their attitudes toward life" (Geertz, 1973, p. 89). Within the context of this study, "culture" will refer specifically to studio culture, as described in Chapter 2.

Design, *design knowledge* or *design practice*: Design is multifaceted; there is no one single way of defining design without missing some salient aspects. Within the context of this study, however, design predominantly defined by describing the nature of design activity as the epistemological grounding of this study is that learning is also situated in activity. Lawson and Dorst (2009) defined design using three descriptive frameworks of: (1) design activities and abilities, (2) design thinking, and (3) levels of design (project, process, practice,

and profession). In the context of this study, "design" is also delimited to architectural design knowledge, skills, and practice.

Ecology or *ecological*: Ecology is the study of interactions between an individual and their environment. In a learning context, "ecological" refers to a perspective of learning as an interactive process between the learner and their physical and social environment in how they make meaning (Tudge, Gray, & Hogan, 1997).

Façade: The face of a building, especially the principal front that looks onto a street or open space.

Model*, or scale model*: A three-dimensional representation of a proposed structure, typically on a smaller scale than the original.

Plan, as in *floor plan*: A scale diagram of the arrangement of rooms in one story of a building.

Section, as in *cross section*: A representation of the internal structure of a building as if it has been cut through vertically or horizontally.

Studio: The "studio" in architectural education is the physical space in which architecture classes are taught, a curricular space, as well as a social and cultural space in which the practice of architecture is learned (Lawson & Dorst, 2009). The "studio" can be conceptualized simultaneously as a class, space, and pedagogical method (Cennamo & Brandt, 2012). Further description of the architectural studio as a learning environment is discussed in Chapter 2, while a description of the architecture studio in the context of this study can be found in Chapter 3.

Overview of the Dissertation

This dissertation presents the research in five chapters. Chapter 1 begins with a description of the studio as a learning environment, an overview of the research objectives and design, and introduces the conceptual framework that guided this study. I also included in Chapter 1 is my positionality as the researcher in this study, addressing any potential biases and assumptions; the chapter concludes with definitions of some of the key terminology used.

Chapter 2 addresses the conceptual framework and the literature review that informed the study. This study drew mainly upon Gibson's (1977) ecological theory of affordances focusing on the interactions of the learner with the social and physical elements of their environment in how the learner makes meaning. Studio "culture", or the review of key literature that informed this study, centers around studies of the design studio as a learning environment in architecture and other design disciplines.

Chapter 3 describes the research methodology and includes the rationale for the research approach, a description of the research context and participant selection, and an overview of the research design, including methods of data collection and analysis. Ethical considerations and issues of trustworthiness and goodness are also addressed, as well as the limitations and delimitations of the study.

Chapter 4 presents the findings of the research. The study revealed the physical affordances of the studio environment were the open layout, public/private workspaces, and co-working in proximity to others. The structural affordances were long blocks of unscheduled work time, alignment between AD 1 and the other courses in the curriculum, the project brief, and the sequencing of the projects, tasks, and deadlines. The pedagogical

affordances were formal and informal critique, mini-lectures, and demonstrations. Four characteristics of studio culture as defined by the literature—(a) a community of learners and architects, (b) centralizing feedback, (c) untimetabled design activity, and (d) experimentation and risk-taking—I intersected with the physical, structural, and physical affordances of the studio identified in RQ1 in how students made meaning of their learning and development as architects.

Finally, Chapter 5 presents a synthesis of the findings by reconnecting to the literature on studio learning and addressing new emergent insights into studio-based learning in architecture. Conclusions were drawn from the major findings and discussed in terms of implications for practice for architectural education as well as those in non-design disciplines utilizing studio-based learning environments. Recommendations for areas of future research and a final reflection on this study are also presented in the final chapter.

CHAPTER 2. LITERATURE REVIEW

This ethnographic case study was conducted to describe the learning environment of a studio course to explore how interactions in the studio environment shape students' understandings and behaviors as they learn the fundamental elements of design and architectural practice. Data for this study were gathered during the semester I spent as a participant-observer in Architecture Design 1, a beginning architecture course in a college of design at a large, public university. Using a conceptual framework of affordances (Gibson, 1979), I describe the various ways the studio environment creates opportunities for social interaction, and how studio culture intersects with the affordances of the studio environment in how students make meaning of their learning. The knowledge generated from this study may help to understand the role of the studio environment in supporting students' architectural knowledge and identity, and provide insight into the relationship between individual-environment interactions and how it shapes the way students make meaning of their learning experiences.

In my review of the literature for this study, I found that most of the empirical studies of students' perceptions of studio-based interactions and how these interactions shape their understanding of architecture have largely utilized conversation analysis or discourse analysis (Lymer, Lindwall, & Ivarsson, 2011; Melles, 2007; Murphy et al., 2012; Oak, 2011). These studies examined interactions at a micro level, providing an analysis of one interactive episode or a singular event as a case and, therefore, did not utilize the scale of investigation of the phenomenon I was seeking. Nevertheless, I did note a few studies applied ethnographic approaches to investigate the complex ecology of the studio learning

environment in design education that helped me form a pivotal foundation for my own investigation. A summary of these works follows. I start the chapter with a description of the conceptual framework used in this study—Gibson's (1979) theory of *affordances* and extensions of this theory by later authors. I also include a discussion on studio *culture*, including Geertz's (1973) definition of culture and explorations of studio culture from the literature. The chapter concludes with an explanation of how the framework provides an analytic and interpretive structure to my investigation (Anfara, Mertz, & Molasso, 2006).

Conceptual Framework

This ethnographic case study provides a rich description of the learning environment of a studio course to explore how interactions in the studio environment shape students' understandings and behaviors as they learn the fundamental elements of design and architectural practice. Using a conceptual framework of *affordances* (Gibson, 1979; Greeno 1994), I describe the various ways the studio environment creates opportunities for social interaction, and how studio culture intersects with the affordances of the studio environment in how students make meaning of their learning. The conceptual framework used in this study provided guidance regarding the research design, and was also utilized for reporting the study's findings as well as an analysis and interpretation of these findings.

Affordances

Gibson's theory of affordances

The term "affordance" as a theoretical construct was first introduced by perceptual psychologist J. Gibson as an ecological alternative to cognitive approaches to learning and behavior (Gibson, 1977). Gibson (1977, 2014) defined affordances as the possibility for

action formed by the relationship between an individual and their environment; "the affordances of the environment are what it offers the animal, what is provides or furnishes, either for good or ill" (1979, p. 127). Gibson developed affordances as a way to study direct perception, versus inferential or indirect perception. Inferential perception theories posit that meaning arises inside an individual through interactions with the physical and social environment; the agent develops an internal representation of the world based on their interaction with it. On the other hand, direct theories of perception propose that the environment inherently holds meaning separate from the individual, and the individual agent gathers meaning from this meaning-laden environment through the actions it affords (Chemero, 2003; Nye & Silverman, 2012). Gibson's theory supported the latter; if the role of perception is to enable action, and an affordance is a resource that the environment offers if the individual has the capabilities to perceive and use it (Jones, 2003).

Gibson's definition of affordances appears to cut across a subjective-objective divide by being both properties of the environment and of the individual agent. However, the "both/and" quality of Gibson's definition of affordances has caused confusion within the academic community about what an "affordance" is and where it is empirically located (McGenere & Ho, 2000). Various scholars have attempted to develop a coherent theory of affordances through their own interpretations of Gibson's scholarly work (see, for instance, Jones, 2003). These interpretations have led to competing views of affordances in the literature, as outlined by Chemero (2003). Chemero stated that, while most scholars agree that affordances are properties of the environment that have significance to individual behavior, differences centralize around what kind of properties affordances are. Arguing that affordances cannot exist independent of those who perceive and act upon them, Chemero

emphasized, according to Gibson's theory, affordances are found in: (a) the relationship between the individual and their environment when they are acted upon and, (b) they are context and situation-specific. For example, whether a chair affords sitting or standing upon depends on the situation.

Chemero's (2003) clarification assists in the empirical study of affordances in two ways. First, Chemero emphasized that affordances are perceivable and observable; they do not exist solely within the mind of individuals or objects, but are observed through an individual's interactions within their environment. Second, affordances are perceived by individuals, enabling them to act within the context of situations. Therefore, my study centralized on identifying and describing the observable affordances of a specific learning environment, the architecture studio of AD 1, as perceived by my participation in the environment as a participant/observer as well as those affordances perceived by the participant learners in AD 1.

Affordances and situativity theory

To better understand the concept of affordances within the context of learning, Greeno (1994) placed affordances in situativity theory. Situativity theory refers to frameworks that argue that knowledge, thinking, and learning are situated in experience (Nathan & Sawyer, 2014). Greeno noted that within situativity theory, cognitive processes are analyzed as relations between agents and their physical and ecological environments. For example, one may analyze the problem-solving conversation between two students wherein the unit of analysis is the interactive collaboration between the two rather than the individual's mental constructions for problem-solving. The subject of study is the act of

conversation and the ecological conditions that support or constrain the process; the phenomena under investigation is the agent-situation interaction.

Within this view, Gibson's concept of affordances are key. In any interaction between a learner and another system (e.g., physical, social), the conditions that enable these interactions include properties of the learner and the other system. Affordances, therefore, refer to whatever it is about the environment that contributes to the interaction that occurs (Greeno, 1994).

Empirical studies of affordances in learning environments

Researchers have used the term "affordances" in educational contexts to describe the relationship between the properties of the intervention and characteristics of the learner that enables the learning to occur (Kirshner, 2002). Use of the concept of affordances has been applied in diverse contexts such as second or additional language acquisition, mathematics and science learning, human-computer interaction and computer-supported learning environments, and physical learning spaces and professional contexts.

Van Lier (2000) cited affordances as a theoretical construct for second (additional) language acquisition; from an ecological perspective, when the learner is active and engaged they perceive linguistic affordances in the environment and use them for "linguistic action" (p. 8). The linguistic learning affordances of gestures, banter, or songs can be examined for qualities that aid in second or additional language learning. Likewise, Kozma (2003) examined the cognitive and social affordances of multiple representations in science learning. Observation protocols demonstrated students working back and forth between models, graphs, and video representations allowed for convergence on shared meaning of an

underlying chemical concept. In mathematics, Brown, Stillman, and Herbert (2004) applied the notion of affordances to the design of a technology-enhanced mathematics curriculum, and examined tools such as graphic calculators and computer algebraic systems. In each of these contexts, the use of affordances and constraints as a framework allows for researchers and practitioners to determine pathways in the curriculum that enhance learning achievement and engagement.

In the field of human and computer interaction (HCI), the use of "affordance" as a theoretical construct has become increasingly popular, as inspired by the textbook, *The Psychology of Everyday Things* (Norman, 1988). Affordance has also become a common theoretical framework in studies of information communication and technology (ICT) in learning, computer-supported collaborative learning (CSCL), and virtual learning environments (VLEs). Several researchers have examined the affordances of social media (Dabbagh & Kitsantas, 2011; Manca & Ranieri, 2013), blogs (Deng & Yuen, 2011; Robertson, 2011), and virtual worlds such as Second Life (Linderoth, 2011). These studies centralize themes and issues regarding the qualitative characteristics of technological tools and virtual environments, and the ways students and instructors perceive and use them to inform the design of tools and spaces that promote student agency in computer-supported learning. Research by Kirchner and colleagues (Kirschner, 2002; Kirschner, Strijbos, Kreijns, & Beers, 2004) on the social, educational, and technological affordances has demonstrated how elements of the environment afford the emergence of social interaction that supports the acquisition of targeted competencies (Kirschner, et al. 2004).

Studies of the affordances of physical learning environments also exist in the literature, albeit less frequently than virtual learning environments. Studies of formal and

informal learning spaces (i.e., classrooms, research labs, or lounges) have utilized affordances as a conceptual framework to illustrate instructors', and students' perceived and actual use of these spaces to foster social interaction and student agency (Monahan, 2002; McDonald, 2015). Similarly, Billet (2004) argued for conceptualizing work places as learning environments by illustrating how the workplace affords "local negotiations" (p. 12) of knowledge-use, roles, and practices that shape how people participate and learn through work.

It should be noted that, to date, I have not located any published literature that applies the concept of affordances to examine studio learning environments in design or architecture education. Therefore, the current study extends the literature to include application of the conceptual theory in design learning environments.

Application of affordance

Gibson's (1979) theoretical concept of affordances, as extended by Greeno (1994), was applied to this study as follows. The qualitative properties of the spatial, structural, and pedagogical characteristics of the AD 1 learning environment are described in in conjunction with participants' actions within a situation. For instance, the desk critique (a pedagogical characteristic of the studio learning environment) allows for simultaneous showing and telling of knowledge (the act) by the instructor to student on an individual level (the situation). Therefore, the affordance is the relationship between these three elements, not within any one of them individually. In this study, the affordances of the learning environment of AD 1 will be richly described in Chapter 4 in terms of the qualitative characteristics, the actions of students and instructors, and the situations simultaneously.

Studio culture

The studio as a learning environment has a long history in architectural education, and as such, has developed a distinct set of social normalities and regularities, or a studio "culture". Studio culture is not explicitly defined in the literature, but is instead characterized by the collective experiences of current and former students who learn architecture through immersion in the studio environment. The American Association of Architecture Students (AIAS, 2002) succinctly summarized the everyday experiences, habits, and patterns within the architecture studio, stating

> Those who have studied architecture undoubtedly have vivid memories that characterize their design studio experience. Late nights, exciting projects, extreme dedication, lasting friendships, long hours, punishing critiques, unpredictable events, a sense of community, and personal sacrifice all come to mind. Those aspects are not usually written into the curriculum or even the design assignments, but they are likely the most memorable and influential. The experiences, habits, and patterns found within the architecture design studio make up what we have termed "studio culture". (p. 4)

These everyday actions and rituals of studio learning as described by the AIAS (2002) are fraught with symbolic cues for the students and instructors participating in them. Studio culture has become embedded in the broad cultural context of the architectural profession and architectural education through a rich history of architectural education, and the design studio still serves as the center of architectural learning and development.

Studio culture, while not explicitly defined in the literature, has been characterized both positively and negatively as, for example: a sense of community (AIAS, 2002); casual and social (Samsuddin, 2008); centralizing feedback (Anthony, 2012; Cross, 2006, Collins, 2006), reflection-in-action (Schon, 1983); untimetabled design activity (Larson & Dorst, 2009); a visual and material character (Vyas, van der Veer, & Nijolt, 2013); late nights and

long hours (AIAS); poor work-life balance (Anthony); and punishing critiques (AIAS; Anthony; Blair, 2006). The social norms of studio become engrained in architects' professional actions and behaviors long after they leave school (Anthony, 2012). I posit that these cultural norms are tacitly transmitted via the instructors to the students, or among the students themselves, through everyday actions in the studio learning space and intersect with the affordances of the studio environment, either supporting or hindering the affordances for learning in the studio environment.

Origins. The origins of studio culture as it has evolved in architectural education can be traced to the École de Beaux-Arts in Paris in the 19th century. This system began to migrate to North America in the late 19th and early 20th century (Anthony, 2012). In the École, students focused on the study of design as soon as they entered architectural school, where the *aspirants* (novices) would learn under the tutelage of a *patron,* or master architect, in an *atelier* studio workshop. Assignments revolved around an authentic design problem, which took precedence over the lecture as the primary teaching method (Anthony). Aspiring architects also worked side-by-side with the older, more experienced students (*les anciens*) emphasizing the social nature of learning within the architecture studio (Zubovich-Eady, 2013). The *charrette,* or design competition or exercise, usually involved sleepless nights and tight time constraints (Anthony). Once a charrette was completed, a jury of practicing architects would evaluate the work of the students behind closed doors. The jury decided who passed and who failed, and the students who passed were allowed to progress to the next level of the curriculum. To receive a diploma, students had to win a series of design charettes, complete a thesis, and complete a year of internship within a professional studio (Anthony). The pedagogical system and studio culture of the École was transmitted to North

America in the late 19th century and adapted the studio to its new context. As private and public colleges in the United States placed increased emphasis on design instruction, the culture of the atelier, with its charrettes, juries, competition, and social learning, flourished in its architecture schools and remains a central cultural element of architectural education today (Anthony).

The collaborative, "learning by doing" of the Bauhaus. By the late 1920's however, a challenge to the culture of the École emerged; instructors and students started to view its pedagogical methods as archaic and its emphasis on juries as unhelpful. Sharp criticism was aimed at the jury system, which was viewed at prizing winning over learning (Anthony, 2012). The Bauhaus school, established in Germany in 1919, recognized the power of the architecture studio as not only a physical space where design is practiced, but a social and cultural space in which the practice of architecture is learned (Lawson & Dorst, 2009) Its curriculum was built around workshops and laboratories that prized innovation through collaborative, hands-on projects – some on actual work sites (Anthony).

The influence of the Bauhaus' "studio pedagogy" spread around the world, most notably to the United States, where many former Bauhaus instructors moved west to teach at the most prestigious American architecture schools (Lawson & Dorst). In the U.S. the "learning by doing" approach of the Bauhaus converged with progressive American theories such as those promoted by John Dewey and other educational reformers who saw students and instructors as equal partners in the learning process (Anthony). In American architecture schools, collaboration between students was emphasized, and large communal spaces were created where students from all disciplines and levels could work together. The closed jury format was abandoned, and students presented their work publicly, one by one in front of a

jury. Classmates, other instructors, and casual observers were welcomed to listen in, and students received feedback from the jury in person. These changes made a transformative impact on studio culture, and created a unique collaborative teaching and learning environment unlike others found on university campuses (Anthony).

Advantages and disadvantages to studio culture. At its best, the studio created strong social bonds among students, and offered them dedicated spaces to work in casual environment which encouraged interaction and peer feedback (Anthony, 2012). One positive aspect of studio culture was well-documented by Donald Schön (1983) who positioned the dialogue of the desk crit as emblematic of the 'reflection-in-action' of deep learning. However, studio culture could also be detrimental to learning and destructive. The design jury was still the focal point of the educational experience, and reports of students staying up all night to complete projects while insensitive reviewers offered harsh criticism of their work were rampant. The academic "hazing", which left students demoralized and confused, led to many students quitting the study of architecture all together. The urgency to address issues of studio culture became urgent when studio-related injuries and deaths from sleep deprivation were being reported from architecture schools across the country (Anthony).

Demand for reform. Demand for reform of studio culture took hold in the 1990s, led also by a comprehensive report on architecture education by Ernest Boyer and Lee Mitgang (1996) published under the auspices of the Carnegie Foundation. The authors challenged the discipline to engage in critical discussion around whether studio culture creates a climate for learning through open and effective communication, how successfully architecture schools have opened doors to underrepresented groups of students and faculty, and whether students are given the time and support to fully engage in campus life (Boyer and Mitgang, 1996).

Likewise, two critical reports by the Association of Architecture Students (AIAS 2002; 2008) further highlighted the dangerous behaviors and attitudes perpetuated by studio culture. An emphasis on personal sacrifice resulting in poor work/life balance, the prominence of the studio courses over other courses in the curriculum, constant pressure on students to meet demanding deadlines, a learning culture that values competitiveness over collaboration, a harsh climate of feedback and positioning of the instructor as the center of power in the studio environment (AIAS, 2002). In response, the National Architecture Accreditation Board (NAAB, 2004) required that all schools have a written policy on the culture of the studio environment to promote a "positive and respectful learning environment" with guidelines that encourages respect among students, faculty, administration and staff and addresses issues of time management between faculty and students (Anthony, 2012; NAAB, 2004).

Studio culture and studio pedagogy. It is worth noting the distinction being made between studio culture and studio pedagogy. Pedagogy is defined by the basic premise of "any conscious activity by one person designed to enhance learning in another" (Watkins & Mortimore, 1999, p. 3) and commonly referred to as the method and practice of teaching (Oxford English Dictionary, 2000). Culture, on the other hand, is "an historically transmitted pattern of meanings embodied in symbols, a system of inherited conceptions expressed in symbolic forms by means of which [people] communicate, perpetuate, and develop their knowledge about and their attitudes toward life" (Geertz, 1973, p. 89). If culture is conceptualized as a way of life and learned behavior, both culture and pedagogy share many meanings. Giroux (2000) described culture as where identities are constructed

and where people perceive their relationship with one another and the world. Culture is therefore inherently pedagogical (Soetaert, Mottart, & Verdoodt, 2004).

In this study, however, I make a distinction between studio pedagogy and studio culture. Studio pedagogy refers to the characteristics of studio teaching, namely instructor-designed and –led learning activities such as critiques and reviews and other assessments, lectures and demonstrations, field trips, projects and assignments. Studio culture refers to the social norms of the studio environment, many of which have been formed by the distinct style of pedagogy in the studio throughout its history. These social norms are laden with meaning, intersecting in "webs of significance" (Geertz, 1973, p. 5) that dictate human action and are not necessarily promoted or dictated by the instructor. Therefore, it is implied that elements of studio culture are commonly held practices and implicit assumptions that are passed among instructors and students and are not unique to one studio course or environment.

Studio culture and affordances. Studio culture can play a role in the effect of the studio learning environment on the development of architecture students, for good or ill; therefore, culture is a mediator of affordances of the architecture studio (Ingold, 1992). According to Kaufman and Clement (2007), culture consists of "attentional commonalities" (p. 25) that mediate the perception, qualification, and recognition of the salience of an affordance, and can possibility inhibit opportunities for action. In other words, there is cultural variation in the degree of salience one places in social affordances, such as relationships, situations, or rules. If meaning is culturally constructed, and affordances are

given value by those who perceive them, then culture determines the use-value of the affordance.

Application. A simplistic or unitary account of learning in the studio environment would examine affordances of the studio without mention of the plurality of ways studio culture intersects with these affordances. I argue that "studio culture" intersects with the affordances of the studio environment, either leveraging or weakening the value of the affordance. Using Geertz's (1973) "thick description" and study of culture as a guide, I examined how studio culture, as defined by the literature and experienced by the participants in this study, intersected with the affordances of the architecture studio in how students made meaning of learning experiences in one architecture studio course.

Ethnographic Studies of the Studio as a Learning Environment

Ethnographic methods have been used to describe educational practice and social interactions in the studio, and how these practices and interactions shape students' meanings and understandings of design knowledge and practice (Button, 2012; Cennamo & Brandt, 2012; Dannels, 2005; Gray, 2014; Martin, 2012). The central tenants of the ethnographic approach emphasize that all human action is suspended in webs of significance which can be understood through the interpretations of the everyday lives of individuals and the contexts in which the events and social interactions unfold (Prasad, 2005). These studies theoretically describe design learning by investigating the nature of studio-based interactions, how students understand the significance of these actions, and interpret from these activities lessons about the norms, values, and perspectives that support these students' emerging knowledge in design (Brandt et al., 2013; Cennamo & Brandt, 2012; Morton, 2012). The

studies presented in the literature review illustrate the studio as a complex system with properties and processes that support students' meaning making, and emphasize the relationship between pedagogical structures and social interactions of the studio in how students understand design knowledge, conventions, and values of the profession.

Studio as a complex ecology

Drawing upon previous research on aspects of design studios and the social and epistemological implication of studio practices, Shaffer (2003) illustrated learning in the architecture studio through an ethnographic study of the "Oxford Studio", an architectural design course at the Massachusetts Institute of Technology (MIT). Shaffer created a model of architectural studio pedagogy in the Oxford Studio as three, interdependent, structural layers, from the outside, in: (1) surface structures (time, space, resources, and materials), (2) pedagogy (learning activities, feedback, and assessment), and (3) epistemology (the substantive underpinning of the studio in expressive activity). These layers, Shaffer noted, form a "coherent system of activity" that supports students' epistemological understandings of architectural practice.

Upon initial reflection, Shaffer's model of studio activity aligns with Shulman's (2005) description of signature pedagogies as having a surface structure, deep structure, and implicit structure. However, unlike Shulman, who neglected to explain the relationship between these structures in his framework, Shaffer described these layers as nested within one another, and focused on the relationships *within and across* the layers in the Oxford Studio, implying a network of social interactions inseparably connected within the setting of the studio. For example, flexible hours with open blocks of time (surface structure), support

learning activities such as critique (pedagogy). These pedagogical activities in turn support design ideas (epistemology), for instance, that design ideas are developed iteratively. These layers draw parallels to personal ecology (Liber & Johnson, 2008) which entails interactions of people with the human and non-human systems that surround them.

Shaffer's (2003) ethnography of the Oxford studio presents the studio as a *complex ecology*; a coherent system of activity in which theory and activity are inseparably connected. Students are forming their epistemological understandings of design while shaping their professional identities as architects, aligning individual, community, and environment interactions within a "set of practices that incorporated a particular approach to understanding" (p. 28). Rather than presenting the studio as a series of isolated elements, Shaffer presented the studio as a richly authentic learning environment that initiates students into a community of practice (Brown, 2006; Brown & et al., 1989; Lave, 1991). In this study, examining the complex ecology of the studio provides a description of how the system of activities in the studio creates opportunities for action that support or constrain students' knowledge of design practice.

Studio as a community of practice

Morton (2012) investigated learning using Wenger's (1998) community of practice (CoP) by conducting a case study in an architecture studio. Morton's (2012) objective was twofold: first, to use CoP to analyze participation patterns in the studio and "the extent to which co-participation constituted effective preparation for becoming an architect"; and second, to determine whether CoP provided "analytical purchase" on the teaching and learning practices of academic classrooms (p. 101). CoP frameworks have been embraced by

higher education scholars; and, since architecture grew from an apprentice-based craft, Morton initially agreed with previous research that studio-based learning practices could best be understood through a CoP framework. However, Morton found opportunities for students to rehearse roles that are similar professional architecture were limited. For example, while students were engaged in the process of design, the main pedagogical genre, critique, constrains students' abilities to perform as architects. The relationship between the student and the instructor was hierarchical and directive. Instead, the instructor used the critique to model "how to think architecturally…for example, what to attend to…or how to manipulate artifacts that might lead to new knowledge" (p. 109). Despite these constraints, Morton also found that students felt their participation in the studio was integral to their trajectory of becoming professional architects.

Students also reported seeking and engaging in legitimate peripheral participation (Lave, 1991) in architecture outside of their formal studio instruction. Rather than conceptualizing the architecture studio as discrete community, Morton suggested the studio was just one of many overlapping, intersecting communities that students engage in in forming their disciplinary and professional identity.

These findings revealed that social interactions in the studio are "neither embedded in a community of practice, nor a replica of professional work" (Cennamo & Brandt, 2012, p. 844), underscoring the complexity of researching learning in higher education environments. Although there were similarities between the architecture studio and architectural practice, applying a CoP framework did not recognize the uniqueness of the academic culture of the studio environment. Instead a notion of "ecologies of participation" (Boylan, 2010) allows for legitimate peripheral participation as just one form of participation within a social system,

opening up the possibilities for other forms of participation that support learning, such as peer learning and students' interactions with materials and objects. An ecological approach in the current study allowed for investigating participation in the studio as inter-relational between a particular situation and a set of interactions, perceptions, and practices of the learner that support or constrain their understanding of design.

Architecture studio as a practice field

Similar to findings as previously discussed, Cennamo and Brandt (2012) found that a blanket application of a CoP perspective to the architecture studio to be "problematic and inaccurate" (p. 844). They preferred to conceptualize the studio as a "practice field" (Barab & Duffy, 2000) by identifying examples where students are working toward developing their identity as architects, and situations where faculty negotiate between professional and academic worlds to learn more about how studio practices can be adapted to other content areas. The study revealed key interactions that "afforded reflection for individual and group knowledge-building" (Cennamo & Brandt, p. 849): public rehearsal of reflection-in-action, peers listening-in on critiques, instructor modeling, meta-discussions during project critiques, focused assignments, and in-process critiques.

Cennamo and Brandt (2012) found that the "right kind of telling" (p. 839), a type of coaching and modeling (Collins, 2006), where instructors use public dialogue as springboards for meta-discussions, contribute to students' success in the studio and help them develop their identities as designers and the norms and practices of design. Dialogue frequently serves a problem-solving mechanism, and teachers use students' work to elevate discussions to an epistemological understanding of the discipline, and through these

discussions, students develop a sense of what constitutes "good design" in their field (Cennamo & Brandt).

Cennamo and Brandt's (2012) findings provide insight into the ways that dialogue and other social interactions support students as they develop architectural knowledge and provide practical examples of the key guidelines in how to implement studio-based instruction in alternate disciplines. However, what was missing from their study was the students' perspectives of the key interactions that led to their increased understanding, or how the studio environment affords opportunities for interaction that support their meaning making. The current study provided a description of the nature of the social interactions that afford learning from the students' point of view.

Studio and academic and proto-professional interactions

Gray (2014) conducted a critical ethnography of a Master's program in Human and Computer Interaction (HCI) to capture the occurrences and structures of communication, namely the design critique, by design students. Through analysis, Gray identified system relations that allowed for student-led interactions in the studio and encouraged reproductions of these interactions. For example, students' participation in professional internships allowed them to practice knowledge they gained in their studio courses in authentic contexts, many times being challenged to justify or defend their identities as designers. Mentoring activities also allowed for interactions between students at different levels of their education, resulting in a sharing of processes, resources, and tools. Gray also noted that students reproduced studio culture in actions parallel to the formal curriculum through informal, student-led activities and mentoring.

Within these systems, students worked within two different fields of action: one oriented towards their academic community and patterns of student-instructor behavior, and a second oriented toward the professional community. Gray's (2014) findings connect to Cennamo and Brandt's (2012) conception of the studio as both an educational space and professional space by comparing roles, typifications, norms, and formal rules, and students' interactions within both fields.

The current study built upon Gray's (2014) work in two ways. First, Gray highlighted ways the studio learning environment (the "systemic forces", pedagogical "structures", as he called them) of HCI allowed for student interactions that supported their knowledge and understandings of design and becoming a professional designer. My study extended this concept by using Gibson's concept of affordances within a first-year architecture studio. Second, Gray contrasted the norms, roles, and rules of the academic studio against that of the proto-professional "practice field", particularly within the context of critique. Examinations of proto-professionalism in architecture education was outside the bounds of this study, however, this study examined the ways in which the norms, roles, and formal rules of the architecture studio intersect with the affordances of the studio environment.

Summary

The findings from these ethnographic studies of the studio environment revealed that the structures, activities, and design epistemology in the studio are highly integrated in supporting students' understanding of architecture. Shaffer's (2003) study demonstrated that practices of the studio are more than just sets of activities in a particular setting. Instead the

context, pedagogy, and epistemology align to support students' understanding of design concepts. For example, large blocks of in-studio time support the ability to devote that time to public critiques which, in turn, become a platform for discussion by using students' work to engage in meta-discussions of key ideas. These findings shift the focus of the inquiry on the relationship among the various elements present in the studio environment. In a holistic, systematic inquiry of learning environments, neither "learning" nor "environment" took precedence; instead, the focus was on the relationship between the learner and their environment in how the learner makes meaning (Jonassen, 2012). Thus, conceptualizing the studio as a complex ecology centralizes the study on the relationships among the various elements present in the studio environment, such as the participants, the academic context, and disciplinary culture, and how these elements interact to support students' meaning making.

The aforementioned studies also revealed the relationship between pedagogical structures and social interactions of the studio not only in how students understood design concepts, but also in how students developed a sense of norms and values of the profession. Interestingly, even though the studio constrained students' abilities to legitimately perform expertise, students still felt that their participation in the studio was an integral part of their trajectory toward becoming a professional (Morton, 2012). The critiques, in particular, were found to be curricular spaces that supported meta-discussions of key concepts of the discipline as well as spaces where students could practice the vocabulary of architectural conventions. The social interaction of the critique not only produces meaning about design, but also produces identities; that is, students' development of self in the context of their participation in a design community.

Nevertheless, the preceding literature has certain limitations. While these studies demonstrated that meaning-making in the studio is largely *relational*; that is, a result of the relationship among the structure, pedagogy, and epistemology in the studio environment, what is missing from these studies are the perceptions of these relationships from the learners' point of view. Learners' perceptions and beliefs are likely mediating the way they interact with the studio environment and, as such, have an effect on the way the learners view the environment as providing opportunities to achieve their learning goals (Gibson, 1979; 2014). As the current study was concerned about students' perceptions of their interactions within the studio environment regarding how they make meaning of their architecture knowledge, the environment is characterized in terms of how the individual perceives it. In addition, as illustrated by Gray (2014), these findings warrant a closer look at feedback, or the critique as a social event in how interactions between the student, and the critique environment support students' understanding of design knowledge and identity.

Critique in Design Education

The "critique"—otherwise known as the "crit", "review", or "jury"—holds a unique place as both a social event and a central pedagogical strategy in art and design education (Dannels, 2003; 2005; Gray, 2013; Murphy et al., 2012). Students in a design studio present their design work and receive oral feedback from their peers, instructors, and professional designers multiple times every semester throughout their academic career (Dannels, 2005; Dannels et al., 2011). The oral feedback method of critique serves as both formative and summative assessment of students' design work, as well as an opportunity for students to

rehearse dialogues and social practices of the discipline (Anthony, 1987; Brandt et al., 2013; Cennamo & Brandt, 2012; Gray, 2013; Murphy et al., 2012; Oak, 2011).

The current literature related to critique in design education is presented in two ways. First, the analytic frameworks of critique found in the literature help to explain the process, feedback, and the ways knowledge is conveyed during critique interactions. Second, the current literature on critique is briefly summarized according to four main types of critique: the desk crit, the pin up, the interim or mid-term review, and the final review or final jury. The section ends with a summary of the literature and a synthesis that focuses on research implications.

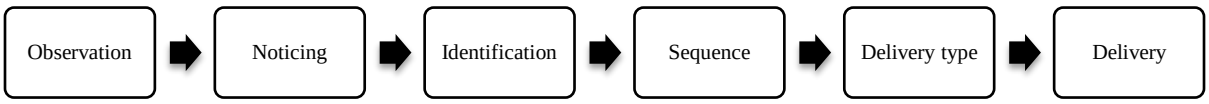
Analytic frameworks

Critique has traditionally been studied from the perspective of the master/student relationship (Gray, 2014). Thus, various analytic frameworks have been developed to explain the process, feedback, and the ways knowledge is conveyed during critique interactions (Gray). These analytic frameworks are important to the current study to better understand how design knowledge emerges because of these interactions. Two frameworks of critique are presented: the process of critique (Oh et al., 2013), and typologies of feedback during critique (Dannels & Martin, 2008). These frameworks will be used to explain the process, types of feedback, and the ways knowledge is conveyed during the critique interactions in this study.

Process of critique

Oh et al. (2013) described a process model of critiquing activity based on how an instructor gives feedback to students. The authors contended the critique dialog has six distinct steps (see Figure 1) moving from initial observation through to externalization of the feedback through delivery types.

First, the critic listens and observes the student's presentation (observation), notices the problems and successes of the design (noticing), and identifies the issues and why they are problematic or successful compared to the learning goals of the project (identification). The critic then considers the order of the student's feedback and what to address first (sequence). For example, the critic can decide to give compliments first, or address problematic issues right away (Oh et al., 2013). The critic then decides how the critique feedback will be delivered (delivery type). Delivery type is the formality of the conversation between the critic and the student, including the content and the typology of feedback (see Dannels & Martin, 2008). Finally, the instructor delivers the critique (delivery). Differences in "language choice, facial expressions, and vocal tone can influence the relationship between instructor and student and the effectiveness of the critique" (Oh et al. p. 317). This process model may be used to determine where in



Adapted from: A theoretical framework of design critiquing in architectural studios by Oh, Ishizaki, Gross, & Do. (2013). *Design Studies, 34*, p. 316.

Figure 1. Critiquing steps

the critique students' design process is elicited, questioned, and feedback offered by the instructor, peer, or visiting critic.

Typology of feedback

Dannels and Martin (2008) proposed a typology of feedback based on a genre analysis of critiques from the point of view of the critic. Table 1 illustrates the types of feedback found in their analysis across various design disciplines. These typologies serve as an analytical tool for the content of the critique feedback where students' affordances are discussed.

Types of critique activity

Critique can be found in various typologies in design education. The most common are the (1) desk critique, (2) the pin up or group critique, (3) the interim or mid-term review, and (4) the final review. Each of these methods range in perspectives according to the formality of social interactions (informal vs. formal), orientation of the interaction (private vs. public), and number of students involved in the critique event (one-on-one vs. the entire class). Figure 2 gives a representation of these critique settings along the three perspectives.

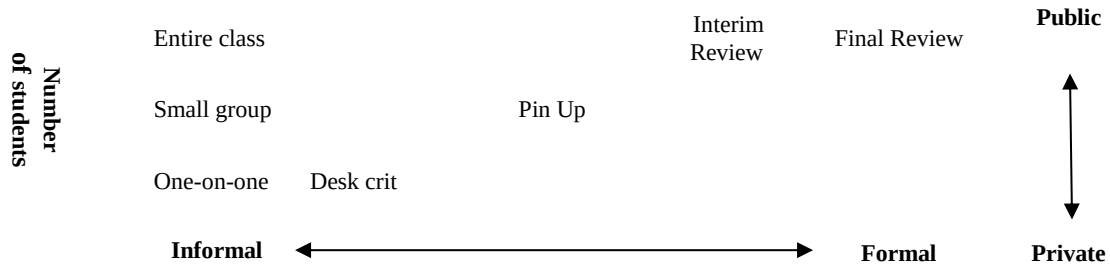
The four main types of critique are: desk crit, pin up, interim or mid-term review, and final review or final jury. They are described briefly according to the literature based on the three perspectives in the sections that follow.

Desk crit. The designer's critique, or "desk crit", is an informal and loosely structured interaction between the designer and critic in a one-on-one dialogue, usually at the designer's desk or work station (Gray, 2013; Oh et al., 2013). Desk crits can take place at

Table 1. Genres of critique feedback

Type of Critique	Description
Judgement	An assessment of quality, evaluative in tone and includes some interpretation and observation.
Process oriented	Focused on students' design approach or process; provides students with observations or insights on their process.
Brainstorming	Questions or statements that include imagined future possibilities for the design, usually formed as 'what if' statements.
Interpretation	Critics' reactions to making sense what they see, with questions or comments seeking clarification.
Direct recommendation	Focused, purposeful statements of advice about a particular design.
Investigation	Critics request information through questioning about the design or design process; usually initiated to seek a response (versus rhetorical questioning).
Free association	Feedback in the form of reactive, associative statements; usually begins with "it reminds me of" or "this looks like".
Comparison	Contrasting the design or the design process with something else in a strategic way, so students can compare their work against another well-known example.
Identity invoking	References to students place within the context of a larger community of professional practice, culture, identity.

Source: Dannels & Martin, 2008.



Adapted from: A theoretical framework of design critiquing in architectural studios by Oh, Ishizaki, Gross, & Do. (2012). *Design Studies, 34*, p. 308.

Figure 2. Three perspectives of critique settings

various intervals throughout the entire course. Dannels (2005) described the desk crit as exemplifying the "master and apprentice model" of learning (p. 144) where the expert, usually the instructor, provides formative, in-process feedback as the student is working on a design problem. As such, the desk crit most closely exemplifies Vygotsky's (1978) *zone of proximal development* where the instructor or a more knowledgeable peer, with guidance and encouragement, helps the learner progress to an advanced level of understanding (Dannels).

The structure and role of the desk crit in enhancing design learning was best articulated in Schön's (1985) book, *The Design Studio*, in which he describes a "design review" between a student, "Petra", and her studio master, "Quist". Through observations of students' in-process work and design tutorials, Schön developed the "frame-move-evaluate" learning cycle of the design process (Lawson, 2004; Lawson & Dorst, 2009; Schön, 1983, 1985). Schön's studies of architectural education in the 1970's highlighted in-process feedback as central to the iterative design process and gained wide attention as a pedagogical strategy for reflective practice in learning (Collins, 2006; Schön, 1983, 1987). Since Schön, researchers have emphasized the value of the desk crit, and consider it to be the cornerstone of architectural pedagogy (Goldschmidt, Hochman, & Dafni, 2010; Schön, 1983, 1985, 1987). Empirical studies have also found the desk crit to be the least stressful and most effective form of feedback in the design studio (Cennamo & Brandt, 2012; Schrand & Eliason, 2012).

Pin up. The pin up review, also known as the "group crit" in the literature, is the name of the pedagogical practice whereby students display their in-process work on the wall and receive feedback from their instructor and a small group of peers (Dannels, 2005; Gray,

2013; Oh et al., 2013). More formal in nature than the desk crit, pin ups serve the function of enabling students to see various solutions to the same design problems, which is especially important for students in introductory design studios (Oh et al., 2013). Dannels (2005) noted the pin up can have different structures, including small group discussion, feedback on multiple projects or just one work, and dialogue initiated by the student or the critic. However, manifestations of the pin up include the public display of students' work with the intent to provide in-process feedback and allowing students to weigh the value of multiple solutions to a design problem. Among the types of critique in the architecture studio, the pin-up or group critique has garnered the least attention of researchers (Gray, 2013).

Interim or mid-term reviews. Interim reviews involve the entire class at important milestones or mid-way through a project or course (Oh et al., 2013). According to Oh et al., instructors hold interim reviews when they think all students would benefit from sharing their progress or knowledge with their peers, or when the instructor sees many students struggling with the same problems. Another important use of the interim review is for students to rehearse their presentations for the more formal final review at the end of the course.

Unlike the more informal pin up or group crit, the interim review may involve external reviewers such as other studio instructors and/or professional architects. During the interim review, a student's work is critiqued by the instructor and external reviewers, while other students listen to the comments and often provide their own feedback (Oh et al., 2013). Despite their formality, the goal of the interim review is to provide in-process feedback, focused on ideas rather than a finished product (Dannels, 2005). For many students, the

formality of the interim review, combined with the focus on formative assessment and ideas, equates to a helpful and effective learning experience (Schrand & Eliason, 2012).

Final review. The final review, or "final crit", is the most formal, public presentation of students' design work and, as such, has garnered the most attention from researchers. In the literature, final reviews are also referred to as architectural "juries" or "juried reviews" (Anthony, 1987). The jury is generally a panel of external critics, usually professional architects, other studio instructors, other non-studio faculty (e.g., engineering faculty or an architectural historian), and representatives of the client for which the design is being produced (Oh et al., 2013). The students' peers do not act as reviewers or critics in this context; peers act as audience members to the critique. At the final review, architecture students present their work on panels (called "boards") and/or physical models of their designs. Students are asked to dress formally for the final review as if they are presenting their work to a client. The jury reviews the work of each student separately, critiquing the work openly and publicly (Dannels et al., 2011). Jurors are sometimes asked to provide a written evaluation of each student, which is factored into the student's final grade for the course. Hence, the final review acts as part of the summative assessment of students' learning in the overall course.

The final review can, in fact, take on various roles other than assessment. The final review is also used as a ceremonial end to a semester-long project, taking on the character of a formal ritual or theatrical feel; the presence of external critics or jurors adds to the formality of the event (Dannels, 2005; Lawson & Dorst, 2009; Oh et al., 2013; Webster, 2006a, 2006b). The final review also acts as a professionalization tool where students learn about

the norms of design interaction (Dannels, 2005; Oak, 2011). The public nature of the final review requires that students "sell" their design to external audiences using ritualized aspects of design-based talk (Morton & O'Brien, 2005; Oak, 2011; Webster, 2006a). External jurors also voice their own personal constructions of "architecture" and "architectural identity" in dialogue with students, which both furthers the final review as a socialization and enculturation device (Gray, 2013).

Due to their high-stakes, public, formal nature, the final review can be a stressful, uncomfortable event for students (Anthony, 1987; Blair, 2006; Dannels et al., 2011; Schrand & Eliason, 2012). In fact, final reviews can be so stressful for students some researchers have questioned the quality of learning taking place (Anthony; Blair). Others (Blair, 2006; Dutton, 1991) have stated that students' need to defend their work in order to receive a good mark or grade interferes with the learning process. Recognizing "critiques of the critique" design educators in recent years have suggested the various pedagogical roles of the final review need to be more clearly articulated to students (Salama, 2010; Webster, 2006b). Student-led critiques, where the instructors and jurors play a reduced role, may be one way to increase the learning potential of and student engagement in the final review (Lawson & Dorst, 2009).

Summary

Critique is an ubiquitous feature of studio learning environments and its effects of students' learning and development has been well-documented in the literature. Less is known, however, about group critique especially when they are peer-led (Gray, 2013), and how students make meaning of design knowledge when communicated through a more

knowledgeable peer. Research has also shown that formal critique serves an important professionalization function despite students' abilities authentically perform actions of the discipline (Gray, 2013; Morton & O'Brien, 2005; Oak, 2011). In many ways, the critique serves as a pedagogical vehicle for instructors to model "good" design practice (Morton, 2012; Morton & O'Brien, 2005). Therefore, the culture of critique carries an epistemological and ideological charge, affecting how students make meaning of the affordances of the architecture studio as a learning environment, and what constitutes "good" architectural practice and useful design knowledge.

Summary

Several overarching points can be made from the existing literature on affordances, learning in the design studio generally, and critique specifically have influenced the design of this study. First, it is evident the studio environment is a complex system with particular properties and processes that support students' meaning making. In the studio, students make meaning of their design knowledge and identity through interactions with the objects, people, and events in the studio environment. Therefore, examining the affordances the environment is a theoretical lens and analytical tool to understanding the ways students act upon these perceived affordances to develop and make use of their knowledge in studio-based learning environments.

Second, it is imperative to investigate the ways culture intersects with the affordances of the studio learning environment. For example, the culture of critique transmits epistemological and ideological ideas of "good" design practice, and is mimicked in how students critique each other in a peer-review situation (Gray, 2014). Culture mediates the

use-value of an affordance, therefore an account of the affordances for learning and development in the studio environment must also describe the ways studio culture intersects with these affordances.

Finally, a thorough search has not revealed any published literature that addresses the concept of affordances to examine studio-based learning environments or learning in architecture or design fields. Therefore, this study will contribute to the body of literature on studio-based learning and design education through using the concept of affordances to describe how physical space, structure, pedagogy and culture interact in a complex ecology to shape students' understanding of the knowledge and practices of architecture.

CHAPTER 3. METHODOLOGY

This ethnographic case study was conducted to provide a rich description of the learning environment of a studio course to explore how interactions in the studio environment shape students' understandings and behaviors as they learn the fundamental elements of design and architectural practice. Data for this study were gathered from the semester I spent as a participant-observer in Architecture Design 1 (AD 1), a beginning architecture course in a college of design at a large, public university. Using a conceptual framework of affordances (Gibson, 1979; Greeno 1994), I describe the various ways the studio environment creates opportunities for social interaction, and how studio culture intersects with the affordances of the studio environment in how students make meaning of their learning. The knowledge generated from this study may help others to understand the role of the studio environment in supporting students' architectural knowledge and identity, and provides insight into how individual-environment interactions shape how students make meaning of their learning experiences.

This chapter describes the research methodology, including: (a) the rationale for the research approach; (b) a description of the research site and participants; (c) a summary of the information needed to carry out the study; (d) an overview of the research design; (e) the data collection methods; (f) methods of data analysis; (g) ethical considerations; (h) issues of trustworthiness and goodness; and (i) limitations and delimitations of the study. The chapter concludes with a summary.

Qualitative Research Design

This study was conducted to provide a thick, rich description of the learning environment of a studio course to explore how interactions in the studio environment shape students' understandings and behaviors as they learn the fundamental elements of design and architectural practice. Qualitative research methodologies provide perspectives on learning that complement and enrich experimental research traditions by investigating complexities in interactions between learners and learning processes (Bransford, Brown, & Cocking, 1999; Land, Hannifin, & Oliver, 2012). As such, the use of a qualitative approach in this study is justified as it is grounded in an interpretive tradition, focused on direct observation and the participants' interpretations of the experience of learning (Prasad, 2005).

Epistemology

This study utilized an epistemological stance from *constructivist* perspectives on research and *constructionist* views of education. It is important to note that constructionism is not the same as constructivism; although they are similar in that they both share the connotation to learning as the building of knowledge structures, there is a distinction between these two epistemologies (Papert, 1980). Constructivism emphasizes the individual self as the builder and constructor of knowledge and meaning, while constructionism focuses on the connected nature of knowledge through personal and social interaction (Sawyer, 2006). While my epistemological stance as a researcher is grounded in constructivism, my view of learning and education is constructionist and situative, and both views inform this study.

Constructivist perspectives of research view knowledge as constructed out of interactions between human beings and their world (Crotty, 1998). Meaning is personally,

rather than universally, defined through interactions between subject and object (Crotty, 1998; Land & Hannafin, 1997). As such, constructivist epistemologies of knowledge recognize that there is no one paradigm or methodology, but rather a number of different ways knowledge is discovered.

Constructionist views position learning as an active process through which students construct meaning through engaging with the world and each other (Bransford, et al. 1999). Learning and knowledge is individually constructed by the learner in a socially situated, public context (Brown & et al., 1989; Jonassen, 2012; Lave, 1991; Sawyer, 2006). I also view knowledge as contextually situated, that intelligence is realized in a complex, built, and socially mediated environment (Sawyer). As such, this study's conceptual framework is based on ecological perspectives on learning and is contextually bound by the studio as a learning environment.

Theoretical perspective

This case study of AD 1 can be viewed through the theoretical perspective of symbolic interactionism. Symbolic interactionism (SI) is a genre of research that emphasizes the creation of meaning in social situations, particularly on the role of the self in the construction of reality (Prasad, 2005). Three basic interactionist concepts form the tenants of this approach:

- Objects and events in the environment have no intrinsic meaning aside from those assigned to them by individuals in the course of everyday social interaction;
- Human beings act toward objects based on the meaning these objects hold for them; and

- These meanings are not predetermined but are constantly being modified through a series of individual interpretations (Crotty, 2011; Denzin, 1992; Prasad, 2005).

Gibson's (1979) concept of affordances corresponds with social interactionism in that objects in the environment are first perceived and then assigned an affordance, or a use-value for action. Therefore, objects and events in the environment hold meaning for individuals and this meaning is judged on how they create opportunities for or constrain actions. However, Gibson's theory deviates from SI in two ways. First, by focusing on theories of direct perception, Gibson stated that objects do, in fact, have inherent meanings, and can detect these meanings and exploit them for use. Second, SI centralizes the self in the construction of reality as the empirical focus, where Gibson and Greeno (1994) emphasized the relations between people and their physical and ecological environments as the principal phenomena under investigation. This case study of AD 1 lies in-between these two foci; through a description of the affordances of the learning environment of AD 1, and the ways that studio culture intersects with the affordances. Therefore, this case study was conducted to explore how interactions in the studio environment shape students' understandings and behaviors as they learn the fundamental elements of design and architectural practice. This ethnographic case study of AD 1 also employs a pragmatist philosophical approach, particularly in a focus on the practical application of the findings of this work to inform architectural education specifically and higher education more widely.

Methodology

The methodological approach I employed for this study is ethnographic. Ethnography is the detailed, in-depth description of everyday life, and gives voice to people

in their own context typically relying on verbatim quotations and thick descriptions of daily events (Fetterman, 2010, Geertz, 1973). The aim of the ethnographic approach is the interpretation of the shared and learned patterns of a culture-sharing group, in order to understand the "webs of significance", or the cultural constructions of that group (Creswell, 2013; Geertz). Although the historical roots of ethnography lie in comparative cultural anthropological research, more modern approaches to ethnography have expanded to include structural, critical, and postmodern orientations and aims (Creswell). My approach to ethnography in this study was guided predominantly by Fetterman (2010), who emphasized the ethnographer's focus on observing, documenting, and interpreting the predictable, daily patterns of human thought and behavior to understand and describe the context from an "emic", or an insider's perspective of reality (Fetterman).

In my study of AD 1, I focused on documenting the qualitative characteristics of the environment, the patterns of behaviors of those within the environment, and the thoughts, opinions, and values of the participants (students and instructors) to understand the learner-environment interactions studio and how students' make meaning of those interactions. To carry out the study, I engaged in extensive field work within the studio setting, collecting data through observations, interviews, and course artifacts, as well my own reflections on site visits, to develop and overall interpretation of the learning environment guided by the conceptual framework.

Case study design

Within a qualitative approach, this study was most suited for a case study design. Case study is the study of a bounded, integrated system of activity within a real-life,

contemporary context, using the case as an illustration of a phenomenon or situation (Stake, 1995; Yin, 2009). Case studies are the preferred methodology when: (a) "how" or "why" questions are being asked; (b) the researcher has little to no control over events; and (c) the focus is on a contemporary phenomenon or issue within a real-world context (Yin, 2009, p. 2). The use of case study approach is appropriate to describe how interactions in the studio environment shape students' understandings and behaviors.

I applied an *intrinsic* case study (Stake, 1995) to better understand a particular situation, context, or occurrence; in this case, the learning environment of a particular college course, AD 1. I hold an intrinsic interest in AD 1, a studio-specific learning environment, with its unique and complex system of activities and social interactions "…in all its uniqueness and commonality" (Stake, p. 1). My goal in this study was to illuminate how students experience, perceive, and assign meaning to architecture knowledge and practice through individual-environment interactions in one particular course. The context of AD 1, as the unit of analysis, is the vehicle one can use to gain understanding of the interactions and experiences under investigation.

A hallmark of case study design is the reliance on multiple methods of data collection to fully illustrate the case under investigation (Creswell, 2013). For this case study of AD 1, I relied on studio observations and field notes, participant interviews, recorded 'studio reflections', course materials, and other artifacts to present an in-depth understanding of the case.

Research Site and Participant Selection

Architecture Design 1

The setting for this study was a section, or "studio" of one course, Architecture Design 1 (or AD 1), in the first year of an architecture program situated in a Design College at a large, public university. AD 1 provides an ideal context for this study for two reasons: (1) it is a studio environment that is typical of bachelors-level study in an architecture program; and (2) it is an introductory course, setting the stage for an elementary understanding of the foundations of architecture knowledge and practice.

AD 1 was scheduled for three days per week, 4 hours per day, from August 24 through December 18, 2015, and students were expected to be present in all class sessions even when instruction is not taking place. These long time tables are typical of studio environments and allow for unrestricted design activity (Lawson & Dorst, 2009). Students enrolled in AD 1 are assigned dedicated desk space in the college to work on their projects that they can also access outside of class time, and there is an expectation that students will do most of their coursework in the studio outside of scheduled class periods. These desk spaces are co-located in an environment that allow for both private working time and public interaction.

Project-based learning in activities authentic to professional practice is also a key feature of studio learning environments. Students in AD 1 worked on three design projects over the course of the semester. The first project ("Project 1") was intended to "launch students into architectural studies" by introducing a concept called the 'building envelope', or the surface, the exterior façade, of a building as a collection of architectural elements. The

second project ("Project 2") was intended to promote analysis of relationships between formal architectural elements in the creation of spatial experiences. Finally, the third project ("Project 3") can be seen as a typical architecture project and involved the comprehensive design of a residential/commercial space on the main street of the city.

Critique was also a central pedagogical feature of AD 1. Within this course there were four types of critique events: desk critiques, "pin-ups", an interim review, and final reviews (descriptions of these events are provided in Chapter 2) spaced evenly throughout the course of the semester. In the interim and final reviews, each of the participants presented their visual work, including a brief (approx. 20 min) oral presentation, after which critics (e.g., peers, instructors, or guest critics) provided feedback and discussion.

Finally, AD 1 is the first course students take in the professional program in architecture at the university, leading to a Bachelor of Architecture (B. Arch) degree. Students apply to the professional program in architecture after a foundational design year in the same college. Therefore, the students in AD 1 are in their second year of university, but in their first year in the professional program of architecture. Most of the students in this study were of traditional college age, of 18-24 years old. In an introductory course, students are being exposed to a new set of pedagogies, projects, strategies, concepts, tools, and people they have not yet encountered in their studies. It was assumed, therefore, that students' pre-existing design knowledge was less focused on architecture in this context. It was also assumed that students encountered a greater emergence of their design knowledge due to their interactions within a new learning environment and system.

Participant selection

As discussed in Chapter 2, the physical and social learning environment in the studio is connected with the development of epistemological ideas of design and design knowledge (Shaffer, 2003). Focusing on one classroom centralizes the attention on how students within this particular learning context make meaning of their knowledge and understandings as a result of person-environment interactions. As such, a pre-determined cohort of students in a particular section of AD 1 were considered potential participants; focusing on one section of AD 1 centralized the study to one learning environment experienced by all participants in the study.

A purposeful sample including a pre-determined cohort of students enrolled in a selected section of AD 1 were considered potential participants. Purposeful sampling is a method that is typically used in case study design (Stake, 1995). There were five sections of AD 1 in fall semester of 2015. Each section of AD 1 enrolled 16 students, purposefully assigned by the course coordinator to ensure diversity in race, gender, and design ability in each section, so each section was similar in student demographics and abilities. Students were assigned to sections two days before the start of the semester. I chose the section for this study prior to assignments; therefore, I did not know the students assigned to this section prior to the first day of the course.

Participants

Participants in the research were solicited via verbal announcement about the research study during the first week of class of AD 1 (see Appendix B-1). On the first day of the course, all 85 students in AD 1 were gathered to discuss the common syllabus and projects in

AD 1. All five studio instructors of AD 1 and the course coordinator led the discussion. Afterwards, the students broke out into their respective sections to arrange their desks. It was during this time I met with the students in Section D for the first time to explain the research study and solicit participation. This announcement included the purpose of the research, a description of their role or participation in the project, and the duration of their participation in the project. During this initial announcement of the research, I also stated my positionality in the research and my background and experience in art and design. The risks and/or benefits of participation were also clearly outlined, and participants were notified that participation in the research project was voluntary and students would not be penalized academically or otherwise if they chose not to participate. Students were handed an informed consent document which further outlined their participation in the research to read on their own.

I returned to the course two days later to give participants the opportunity to self-select via the informed consent document (see Appendix B-2). If they agreed to participate, students were asked to sign the form and provide their email address to arrange for their participation.

In total, nine of the 16 students and the instructor of Section D agreed to participate in the research for interviews and observations. The nine students were: Allison, Brady, Chris, John, Jon, Kendra, Peter, Raven, and Tim [pseudonyms]. The instructor for the selected section of AD 1 was also invited to the research study as a participant after the study commenced. The instructor was handed an informed consent document with outlined the extent of their participation; the instructor signed the form and provided contact information

(Appendix B-3). The instructor was Natalie Day [pseudonym]. A brief biography of each participant is provided based on our discussions during the first interview.

Allison. At 25 years of age, Allison considered herself a "non-traditional" college student, and was the oldest of the student participants in the study. Allison grew up about two hours East of the university and attended a local community college there, obtaining an associate's degree prior to starting her studies in architecture. She identified as a White female. Allison took art classes in high school and loved science, but did not consider a degree in architecture until after earning her associates. Allison shared with me that, while she was bartending between degrees, she met a local architect who helped her *"…come to the realization that architecture was the perfect marriage of science and art."*

Brady. A 19-year-old White male from out of state, Brady was active in a fraternity at the university, and was also taking a class in international politics during the study. Brady described his whole family as being *"…good at art"* but explained he did not become interested in architecture until his senior year of high school, persuaded by his mother and high school art teacher to pursue a creative career.

Chris. As both his father and grandfather were architects, Chris explained that he always knew he was also going to be an architect because *"…it's kind of like a family thing."* He did not take any art or design courses prior to coming to university; however, since he shadowed his father and spent the summer prior to university interning in his father's firm, he had a good idea of what architecture studies entailed. Chris is a 19-year-old White male from out of state.

John. An international student from the Middle East, John attended an international school in his home country and left his studies early to pursue an architecture degree in the United States. At 18, he was the youngest student participant in the study. He identified as multiracial. John explained his international school was extremely diverse, which gave him *"…the experience of dealing with others and respecting their culture."* His interest in math, physics and art led him to pursue architecture.

Jon. A 21-year-old, White male from a nearby city, Jon explained that an architect who taught classes at the local art center was a major influence in his life. He assisted teaching children's architecture classes every summer for three years during high school. Despite his love for architecture, Jon focused on math and physics at his private high school because *"…it was easy"* for him. He originally majored in physics at the university, but transferred to architecture because the environment of architecture *"…is way more fun."* Jon was also pursuing a major in Engineering.

Kendra. A 20-year-old female international student from Asia, Kendra identifies as Asian. She focused on art, math, and physics in a rigorous curriculum at her international high school. Kendra said she did not think about majoring in architecture at first because her father was an engineer. However, she said she came to realize that "architecture is not just design, there is physics to it." She considered architecture as the perfect combination of science and art, plus *"it sounds cool."*

Peter. Peter stated he wanted to be an architect since the age of eight: *"…even at eight, the thought of being an accountant or something sounded terrible. I had to do*

something creative." However, he admitted he struggled with the ambiguity of the creative process. Peter said he enjoyed the technical side of architecture and took a lot of drafting classes in high school. He added that he even considered switching to construction engineering at one point. Peter is 19 years old and identifies as a White male.

Raven. Raven is from the suburbs of a large, regional city. She is 19 years old and identifies as female, White, and Hispanic. Raven has an architect in her family and, since she liked math and art, architecture seemed like a good choice. Her choice of career was confirmed when her father experienced an extended illness, and she spent a lot of time at the hospital. "I got really interested in the health care system, and the way the hospital was designed…there was a specific way it was done," she said. As a result, she wanted to focus on health care in her career as an architect.

Tim. Tim is from a small college town in-state. He passed enough college-level courses in high school to enter the university as a junior. He originally wanted to major in engineering, but he completed one semester and "realized it wasn't for me." Tim is 19 years old and identifies as Asian. Since he was adopted, he felt strongly that his being adopted, Asian, and multicultural was a large part of his identity. Tim's mother was trained as an architect. Although she was not currently practicing, he said he remembered playing with her architecture tools as a child.

Natalie. Natalie is a Senior Lecturer in the Department of Architecture and is the instructor for Section D of AD 1. Natalie identifies as female, and holds a Bachelors of Architecture (B.Arch) and a Masters of Architecture (M.Arch). Natalie's teaching

philosophy was formed through her personal experiences as an architecture student and what she has gleaned about how students learn through her experiences teaching undergraduate students, and through her research on architecture education. She has been teaching AD 1 at the university for eight years, and has been recognized by the university for her teaching excellence.

Data Gathered in the Study

The purpose of this ethnographic case study was to richly describe the learning environment of a studio course to explore how interactions in the studio environment shape students' understandings and behaviors as they learn the fundamental elements of design and architectural practice. The information needed to conduct this study was determined by the conceptual framework and can be categorized in four ways: (a) perceptual, (b) contextual, (c) demographic, and (d) theoretical (Bloomberg, 2012). This information includes:

- Students' perceptions of how studio environment affords actions that support or constrain students' knowledge of design knowledge and practice;
- Students' perceptions about design and descriptions of their design processes;
- Contextual information on the social interactions taking place during studio and during critique sessions;
- Information about the course context, including the course syllabus, course handouts, site visits, and student-generated artifacts;
- Demographic information pertaining to participants, including geographic and educational background, age, gender, and ethnicity;
- A review of the literature providing a theoretical framework for the study.

Overview of the Research Design

This study was ethnographic in nature. The following summarizes the steps that were taken to carry out this research.

Literature review

A selective review of literature was conducted to inform this study. The focus of the review was to gain a better understanding of student-environment interactions in the studio environment and ecological approaches to learning. The review of key literature that informs this study was exploratory, and provided a theoretical "road map" (Fetterman, 2010) through data collection, analysis, and the synthesis phases of the study.

IRB approval

This study had IRB approval, #15-385, which was granted on August 18, 2015; a modification to the study was approved on September 24, 2015. The IRB approval process involved outlining all procedures and processes needed to ensure adherence to standards for the study of human subjects, including participants' confidentiality and informed consent (Bloomberg, 2012). Copies of the approval memoranda are provided in Appendix A-1 and A-2.

Data collection methods

Multiple data collection methods, or "triangulation" (Merriam, 2002) aids in an in-depth understanding of the phenomenon under study by adding rigor, breadth and depth to the study (Bloomberg, 2012; Creswell, 2013, 2014; Merriam). This study employed two primary and two secondary data collection methods. Studio observations and participant interviews were considered primary methods and were given priority during analysis. Studio

reflections (personal reflections on site visits) and course artifacts, such as the course syllabus and assignment handouts, were considered secondary and were used to provide additional contextual information to the study.

Observations

Observations of daily life in the studio were conducted through my immersion in the studio setting as a participant-observer (Esterberg, 2002). I entered the AD 1 environment on the first day of class, August 24, 2015 and was present for almost every class session until December 7, 2015 (approximately 40 class sessions). Toward the end of AD 1, I also attended the studio outside of class sessions on six separate occasions, sometimes into the late evening/early morning hours. I recorded my observations in field notes, written accounts of events, conversations, and interactions in the AD 1 environment. For the first few weeks of the course I took little to no field notes; my goal in the beginning was to enter a reciprocal relationship with the study participants and have them get used to my presence in the studio. For example, in many of the early studio visits I did not take field notes but engaged in the mini-lectures and desk crits with the instructor and students, at times offering my own critique of students' work. Engaging in these early desk crits helped me become an "insider" to the community, and was integral to gaining the trust of participants in the AD 1 environment.

After leaving the studio environment after a site visit, I organized my handwritten notes per the observation protocols as presented in Appendices C 1-4, which were derived from the conceptual frameworks as described in Chapter 2. Field notes on the daily life in the studio were organized according the different dimensions of space, class, pedagogy, and

culture and the critique interaction field notes were organized using a protocol of critique structure and feedback typologies. The reorganized field notes were then used for analysis.

Upon the conclusion of the study, I amassed a total of 106.75 hours of studio observations, resulting in approximately 280 pages of handwritten field notes. Included in this total were 14 separate instances of critiques and reviews: individual desk crits with Natalie and/or other AD 1 faculty (6), pin-ups with Natalie (3), "peer-led" pin-ups or reviews with upper-level architecture students (2), interim reviews (1), and final reviews (2). Other than individual desk crits, Natalie held her critiques "gallery style", meaning multiple critiques happened simultaneously with two or three happening at one time. I attempted to be present at as many critiques as I could; depending on scheduling with my participants I observed between three and eight critiques in each instance. In total, I documented approximately 42 individual critique interactions.

Each studio visit was logged into two separate logs: (1) an overall data accounting log, which recorded the date and type of data collection method, the type of interaction (e.g., daily studio visit, critique, lecture, etc.); and (2) and observation log, which documented the date, start and end time of the observation, and the environment, and the characteristics, interactions, and participants who were foregrounded and backgrounded in the observation to make sure I had captured a holistic view of the AD 1 environment from a variety of perspectives. The observations combined with participant interviews provided information on students' experiences in studio and helped me to distinguish patterns of perception and behavior through both panoramic and detailed views of the learning situation (Fetterman, 2010).

Interviews

Interviews elicited rich, thick descriptions of how participants made meaning of their design knowledge and classroom interactions. In-person interviews also allowed for clarification and probing for additional information. Esterberg (2002) stated that the interview acts as a form of relationship between the researcher and participant, focused around the production of discourse. My use of interviews in this study allowed for capturing perspectives on learning by investigating complexities in interactions between learners and learning processes (Bransford, et al. 2000). I conducted 39 interviews in total for this study; one interview per month (August – December) with each of the student participants, and one interview per month (September – December) with the instructor. All interviews were recorded, and yielded approximately 29 hours of recorded data which were transcribed for analysis.

Student interviews. The interview protocols were guided by the conceptual framework in this study. The interviews mainly focused on eliciting: (1) students' perceptions of the affordances in AD 1 they drew upon to perform their design work; (2) their perceptions of studio culture in AD 1; and (3) their perceptions of architectural practice and professional identity in general. The interviews created an opportunity for students to reflect on to make connections between the opportunities for learning they were afforded, how studio culture intersects with these affordances, and what constituted "successful" architectural and design practice in AD 1. I also recognized that thinking and meaning making in design is characteristically done with visual representation and communication intertwined (Lawson & Dorst, 2009); therefore, I asked students to show their design work to me as they were being interviewed for this study. While they showed me their work, I asked

students questions about their design process and thinking, what aspects of the studio environment informed their progress, and provided feedback on their learning. Even though their choice to do so was optional, all participants shared their design work with me during the interviews, and some shared their online portfolios with me for additional feedback and discussion.

The order and purpose of each of the monthly student interviews were as follows. The first interview was the first official meeting between the student participant and myself. The purpose of this interview was to gain trust and establish a relationship and gain information about the student's perceptions of architecture and their learning in AD 1 at that stage of the course. Initial conversation focused on learning more about their social identities, background, and their knowledge and understandings about architecture as they entered AD 1. Students were then prompted to describe their initial thoughts on aspects of the AD 1 studio environment (space, class, pedagogy) and their initial perceptions of studio culture. Prompts elicited what affordances (such as facts, concepts, tools, methods, practices, events, and people) students perceived as important to or constraining their learning.

The subsequent interviews (interviews 2 and 3) followed the same line of questioning. Students were asked for their thoughts and perspectives on aspects of the AD 1 studio environment (space, class, pedagogy, and culture), and prompts elicited what affordances (such as facts, concepts, tools, methods, practices, events, and people) students perceived as important to or constraining their learning at that stage of the course. Students were also asked to describe any key social interactions they observed or participated in since our previous interview.

The purpose of the final interview was to bring to closure to the data collection process. Conversation focused on reflection by asking students about their perceptions of the quality of their work, of the feedback they received during the final review, and what, in their opinion, contributed to their success or failures of their performance in the course. Students were also asked to reflect upon what they will need to know and do to be successful in their studies in architecture.

Instructor interviews. The interviews with the instructor took place once a month, and were intended for the instructor to reflect upon the learning goals for the project, her perception of students' learning and development, and what she felt supported or constrained students learning and development. The protocol used for the instructor interview was guided by Gray (2014). All instructor interviews were recorded and transcribed for analysis.

Studio reflections

I recorded a brief reflection after each visit to AD 1 to further capture my thoughts on the events and interactions I witnessed in studio and my responses and interpretations of these social actions. I considered these studio reflections an extended field work activity, recording my own feelings and initial interpretations of the data, separate from direct observations. Recording my studio reflections was also a reflexive activity, documenting the connections between myself as researcher and the social world of AD 1 (Saldaña, 2013). In total, I recorded 2.5 hours of studio reflections, which were transcribed and cleaned for analysis.

Course-related documents and materials

I also collected all course handouts, including the course syllabus, project briefs, and all course-related communication that was transmitted in person or online to the students in AD 1. Some items, like the syllabus, were shared with me prior to the start of AD 1; others I obtained via access to the online course management system (given to me by the instructor) or in-person during a studio visit. The course handouts, electronic communication, and other documents and records were unobtrusive means for collecting contextual information about AD 1. Course-related artifacts also provided insight into how the perceived affordances of the studio environment, and the norms and values of studio culture, are transmitted between faculty and students. In total, I collected approximately 46 course-related documents, including those generated by the online course management system, and 26 emails from the instructor to the class; all course-related materials were downloaded or scanned to digital form and cleaned for analysis.

Methods for Data Analysis and Synthesis

Throughout data collection and analysis I organized large amounts of data, reduced the volume of the data, and identified significant patterns in the data (Bloomberg, 2012). In this regard, Merriam (2002) advised researchers to simultaneously collect and analyze data. This section provides an overview of my approach to managing, organizing, and analyzing the data, from the start of data collection throughout the analysis phase of the research, in preparation to report the findings in this study.

The formal process of analyzing the data began by transcribing the recorded interviews and studio reflections, and typing out the observation field notes in long-form, and

downloading/uploading course documents - all of which took place during data collection. The recorded participant interviews and studio reflections were uploaded to *Rev.com*, an online transcription service. The transcriptions were stored on a password-protected online file storage site and a password-protected, encrypted external hard drive. I completed the transcription of the observation field notes myself.

Data were analyzed using a two-cycle method of coding and analysis focusing on identifying patterns or themes in the data (Miles, Huberman & Saldaña, 2014; Saldaña, 2013). The first and second cycles for code mapping are illustrated in Figure 3.

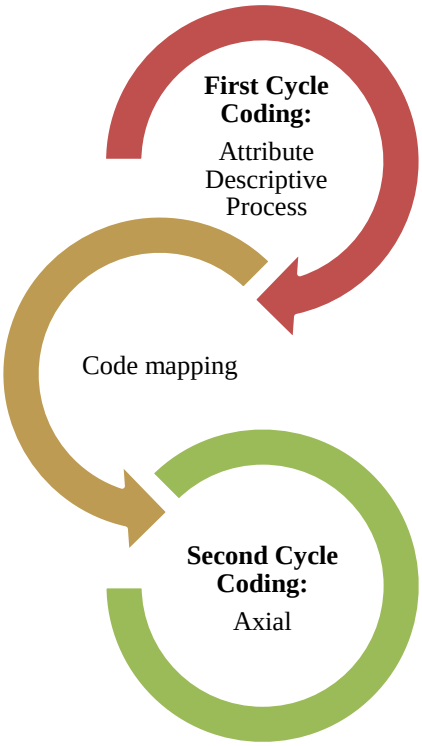


Figure 3. Two-cycle method of coding and analysis

The field notes, interviews, and other data were coded using *NVivo 10*, a qualitative coding software package. The first cycle of open coding began by assigning attribute codes for the notation of basic descriptive information, such as participant characteristics or demographics, data format, fieldwork setting, and other variables of interest for analysis (Miles et al. 2014). Descriptive codes also identified the perceived affordances I witnessed in the studio environment and those mentioned or inferred by the participants during the interviews. Process coding, using gerunds ("-ing" words), along with the descriptive codes, identified how the affordances were enacted or engaged in participants' design work. Sub-codes were used to detail or enrich the entries and allow for more extensive indexing, categorizing, and subcategorizing (Miles et al).

Throughout the coding process, analytic memos were kept to document and reflect upon coding processes, decisions, emergent themes, and patterns (Saldaña, 2013). The analytic memos on code choices and their operational definitions, possible relationships between codes, and connections to (or deviations from) the conceptual framework (Saldaña, 2013). The analytical memos were recorded in *NVivo 10* and used to generate additional codes and categories of themes.

After I completed the first initial review of the data and coding, I engaged in a code mapping exercise to review the first coding efforts. Code mapping allowed for individual codes to be grouped into larger categories and for repetitive or duplicate codes to be collapsed (Saldaña, 2013). Initial coding, code mapping and condensing resulted in one hundred eighty-nine (189) individual codes in 10 code categories.

Then I consulted my analytic memos and engaged in diagramming to examine relationships prior to the second phase of coding using an axial coding approach (Miles et al,

2014; Saldaña, 2013). The qualitative properties of the spatial, structural, and pedagogical characteristics of the AD 1 learning environment were linked to participants' actions or behaviors within a situation. For instance, the open layout (a qualitative property of the physical space) was linked to students and faculty walking to and from studios during work time (action, behavior) and informal critique and discussion around a project (a situation). These linkages were recoded into pattern codes. Pattern codes are explanatory or inferential codes, or codes that identify an emergent theme, configuration, or explanation (Miles et al. 2014). The patterns were grouped into larger themes using an extended phrase or sentence that identifies the groups of patterns and their meanings. The most salient themes, as determined by number of data sources and references within the theme, are presented as findings to answer RQ 1: What are the physical, structural, and pedagogical affordances of the studio learning environment in Architectural Design 1?

I also engaged in axial coding (Saldaña, 2013) to answer RQ 2: "In what ways do the characteristics of studio culture intersect with the affordances of Architectural Design 1 in how students make meaning of their architectural learning and development as architectural professionals?" Data relating to elements of architecture studio culture were identified through *a-priori* codes of "studio culture" as defined by the literature. These codes were then mapped to the physical, structural, and pedagogical affordances identified in RQ1. For example, a "social, casual" learning culture was mapped to the observational and interview data of the physical affordance of "open layout" to examine the relationship between these two codes. Finally, categories of descriptive codes relating to students' perceptions of studio were grouped with the cultural and affordance codes to form causal relationships in axial themes; analytic memos as code notes were kept for each of the themes. The most salient

themes, as determined by number of data sources and references within the theme, are presented as findings to answer RQ 2. The findings are listed by research question and theme in Chapter 4.

Ethical Considerations

In any research study, ethical issues related to protection of the participants are of extreme importance (Bloomberg, 2012). As an ethical researcher, I am primarily responsible for both informing and protecting my participants. Although the participants in this study were under no serious ethical threats were posed to any of the participants during this research study, I employed various safeguards to ensure their protection and rights.

First, no minors or vulnerable persons were involved in this study and all potential participants were informed of their rights and obligations as participants in the research prior to their decision to participate. The invitation to participate in the study clearly stated that participants must be at least 18 years or older to participate in the study. This statement also appeared on the informed consent form that all participants were required to sign before beginning formal data collection. Potential participants were emailed with notification of the research project, including the purpose of the research, a description of their role or participation in the project, and the duration of their participation in the project. The email outlined the risks and/or benefits of participation, and that participation in the research project was voluntary and students would not be penalized academically or otherwise if they chose not to participate. All participants provided a signed, hard copy of the informed consent form prior to the start of data collection.

Second, participants' rights and interests were always considered of primary importance when collecting and analyzing data, and reporting the findings. Participants were given an option to stop the interviews or ask me to quit observing their interactions in the studio space if they felt uncomfortable; however, no participants opted for this. Participants' actual names were replaced with pseudonyms; the name of the course instructor, the course title, and the university has also replaced with pseudonyms. Individual people who are not direct participants in the study are referred to generally by their relationship to a participant (e.g., "a student", "Instructor E", "a peer", "the visiting architect", "the professor", "the reviewer", etc.). During the interviews, both students and their instructor disclosed information about themselves that if made public, could identify the participant. As an ethical researcher, I used discretion and did not disclose any information about a participant that could result in deductive disclosure; my dissertation advisor and methodologist as consultants in this regard.

Cautionary measures were taken to secure the storage of research-related records and data. The transcriptionists employed for this study, *Rev.com*, had temporary access to the interview and studio reflection data via the audio recordings. I uploaded the audio recordings to the *Rev.com* website. All data files were securely stored and transmitted using 128-bit SSL encryption, the highest level of security available. Once *Rev.com* transcribed the audio recordings, an electronic version of the transcription was available for download from the *Rev.com* site using the same 128-bit SSL encryption. I then stored the electronic version of the transcription on in a password-protected on-line storage space and an encrypted, password-protected external hard drive. Once the electronic version of the transcriptions was stored locally, I emailed *Rev.com* and asked that all files be deleted. I transcribed the

observation field notes myself. All data collected in this study were stored electronically and only I have access to the project electronic files and folders through a unique password.

Issues of Reliability and Validity

In qualitative research, issues of reliability and validity are identified to ensure the research has been conducted ethically and systematically for the reader to determine if the findings are trustworthy (Merriam, 2002). In seeking to establish trustworthiness, I aimed to control for potential biases throughout the design, implementation, and analysis of the study (Bloomberg, 2012). Table 2 outlines the various strategies for goodness and trustworthiness as described by Merriam (2002) and how they will be ensured in the current study.

Limitations and Delimitations

This study contains certain limitations, some of which are common critiques of qualitative research in general, and others which are specific to this study's research design. I have been careful to address these limitations and ways of minimizing their impact. The unique features of qualitative research present limitations in its use (Bloomberg, 2012).

Qualitative studies in general are limited by researcher subjectivity (Bloomberg, 2012). However, it is recognized that in qualitative research, especially studies utilizing observational methods, the researcher, the "self", is the research instrument (Esterberg, 2002). To address subjectivity, I stated my assumptions and positionality to both my participants and to the reader in the introductory chapter. Coding schemes have been reviewed by my methodologist, and data and preliminary analyses were taken back to the participants to check for plausibility.

Table 2. Strategies used to ensure for goodness of fit and trustworthiness

Strategy	Description (Merriam, 2002)	Current Study
Triangulation	Using multiple sources of data or data collection methods to confirm emerging findings.	The use of interviews, observations, and secondary data such as course documentation and studio reflections.
Researcher's position or reflexivity	Critical self-reflection by the researcher that may affect the investigation.	An explanation of constructivist/situated learning theory as theoretical lenses; researcher positionality is discussed; reflexivity statements.
Member Checks	Taking data and tentative interpretations back to the participants to ask if they are plausible.	The data and tentative interpretations were taken back to the participants for review after the data collection and first stage of analysis was complete.
Peer review or examination	Discussions with colleagues regarding the process of the study, the congruency of the emerging findings with the raw data and tentative interpretations.	Peer reviews with my methodologist, and an expert in architectural education took place regarding the process of the study and the congruency of emerging findings.
Adequate engagement in data collection	Adequate time spent collecting data such as the data become "saturated".	The use of ethnographic methods such as participant observations, in-depth interviews, and document analysis helped to understand context.
Maximum variation	Purposefully seeking variation or diversity in sample selection to allow for a greater range of application of the findings.	Purposeful sampling of the case, aiming for maximum variation in student demographics and richness of the complexity of the case.
Audit trail	A detailed account of the methods, procedures and decision points in the study.	I kept written notes regarding data collection and data analysis; reflexivity statements.
Rich, thick descriptions	Providing descriptions to contextualize the study to allow for transferability of findings.	Rich description of the contextual lens, site and context of the study; vignettes and testimonies are used to illustrate the uniqueness and complexity of the case

In addition, this study centralized mainly around practices and social interactions in the architecture studio during scheduled class time. Focusing only on in-class learning and interaction overlooks the opportunities for investigating the ways students spend their personal time in shaping their learning and understanding (Bransford et al., 2000). Analysis revealed that outside-of-class interactions also played a dominant role in developing students' architecture knowledge; therefore, my data collection was expanded to outside of studio "class" hours later in the study. However, opportunities to conduct observations

outside studio class hours were difficult for me to arrange, resulting in some logistical limitations to data collection.

Finally, this study was delimited by a case study of architecture students enrolled in AD 1 at a public university. As an intrinsic case study (Stake, 1995), the goal in this study was to illuminate how students experience, perceive, and assign meaning to architecture knowledge and practice through individual-environment interactions in one particular course. Although the findings are not intended to be generalized to other studio-based or design-based learning environments, a rich, detailed description of the case allows the reader to determine transferability to other learning contexts.

Summary

This chapter provided a description of the research methodology of this study. An ethnographic case study methodology richly describes the learning environment of a studio course to explore how interactions in the studio environment shape students' understandings and behaviors as they learn the fundamental elements of design and architectural practice. The case under investigation is a first-year architecture studio, AD 1, in a professional program of architecture at a large, public university. The participant sample was purposefully selected students as a pre-selected cohort of students with one studio instructor. Data collection methods, including observations, interviews, course materials, and studio visit reflections were reviewed against the literature and analyzed for emergent themes. Goodness of fit and trustworthiness were accounted for using various strategies, including ethnographic methods of data collection and peer and participant reviews of instruments and data.

A review of the literature on ecological theories of learning and previous studies of the studio as a learning environment was conducted to create a conceptual framework for the design and analysis of the study. A multi-stage analysis allowed key themes from the findings to be identified. In Chapters 4 and 5, interpretations and conclusions are drawn by comparing the findings of the data analysis and the literature, and recommendations are offered for both educational practice and further research. It was anticipated the knowledge generated from this study will help to understand the role of the studio environment in supporting students' architectural knowledge and identity, and provide insight into how individual-environment interactions shape how students make meaning of their learning experiences.

CHAPTER 4. FINDINGS

This ethnographic case study was conducted to provide a rich description of the learning environment of a studio course to explore how interactions in the studio environment shape students' understandings and behaviors as they learn the fundamental elements of architectural practice. My assumption based on a review of the literature was that students assign different meanings to the objects, events, and social interactions in a studio environment, and studio culture intersects with how students make meaning of these interactions, shaping their understandings of the practice of architecture.

Because the studio environment encompasses many different, concurring interactions, I employed an ecological lens to focus my case-based inquiry on two main research questions (RQ):

1. What are the physical, structural, and pedagogical affordances of the studio learning environment in Architectural Design 1? and
2. In what ways do characteristics of studio culture intersect with the affordances of Architectural Design 1 in how students make meaning of their architectural learning and development as architectural professionals?

This chapter presents the key findings from approximately 106 hours of studio observations, 39 in-depth interviews with nine students and their instructor, course-related documents and materials, and my own reflections on studio visits. The physical affordances of the studio environment included an open layout, public/private workspaces, and co-working in proximity to others. The structural affordances were long blocks of unscheduled work time, alignment between AD 1 and the other courses in the curriculum, and the project brief, and the sequencing of the projects, tasks, and deadlines. The pedagogical affordances

were formal and informal critique, mini-lectures, and demonstrations. Four characteristics of studio culture as defined by the literature are: (1) a community of learners and architects; (2) centralizing feedback; (3) untimetabled design activity; and (4) experimentation and risk-taking, intersected with the physical, structural, and physical affordances of the studio identified in RQ1 in how students made meaning of their learning and development as architects.

This chapter provides a discussion of the findings of the research with descriptions that support and explain each result. I focused on the most salient themes, as determined by number of data sources and references within the theme, as described in Chapter 3. The findings under each research question are presented thematically, with descriptive narratives of an observed cultural scene or key event in the studio woven throughout the chapter to convey the feel of participants' daily life in the studio environment (Fetterman, 2010). Verbatim quotations are also included as illustrations of thematic findings and contain surface and deep, embedded meaning about the participants' lives in the studio (Fetterman). Thick, narrative descriptions and verbatim quotations are signifiers of goodness and trustworthiness in ethnographic research (Fetterman; Geertz, 1973; Merriam, 2002). The findings are presented with various assumptions and limitations so the reader may judge the transferability to their own context. A summary concludes the chapter.

Affordances of the AD 1 Environment

Research Question 1: What are the physical, structural, and pedagogical affordances of the studio learning environment in Architectural Design 1?

The physical affordances of the studio environment included an open layout, public/private workspaces, and co-working in proximity to others. The structural affordances

were long blocks of time, alignment between AD 1 and the other courses in the curriculum, and the project brief, and the sequencing of the projects, tasks, and deadlines. The pedagogical affordances were formal and informal critique, mini-lectures, and demonstrations. The findings of RQ 1 are summarized in Table 3.

Table 3. Summary of thematic findings for Research Question 1

Physical Affordances	Structural Affordances	Pedagogical Affordances
Open learning/working space	Long blocks of course time	Informal critiques: Showing and telling
The desk as personal work and exhibition space	Alignment with other architecture courses	Formal critiques: Interim and final reviews
Co-location and working in proximity to others	The project brief as a framing device	Mini-lectures and demonstrations
	Project sequencing, pacing, and the "staging" of the design process	

Physical

The properties of the physical space of the design studio afforded important student learning behaviors. The open layout of the studio spaces in AD 1, combined with the public nature of the desks/workspaces as a space for students to personally exhibit their work in progress, afforded frequent feedback and conversations surrounding the design process among peers. Dedicated desk space afforded students the opportunity of uninterrupted production, "pin up" space to reflect on how their work changes over time, and for some, allows a sense of belonging to the architecture department. Students' working in proximity to each other, and to other studios in AD 1, also afforded instructor and peer feedback and

social interaction; proximity also afforded students' frequent comparing and self-assessing of their design process against others, monitoring their learning and performance against their peers.

Open learning/working space

Natalie's studio was situated between two other studios of AD 1 (who will be referred to as Instructors "C" and "E"), and students' arranged their desks with a clear path of travel through the middle of the studio, as indicated by the red arrow in Figure 3. The open layout of the studio reveals a clear path of travel through the studio space. Although unintentional, this layout, with groupings of desks around the center table and a walking path between the two other studios, proved to be a pivotal environmental aspect that afforded frequent interactions with other students in AD 1, particularly with Instructor C's and E's students, and instructors.

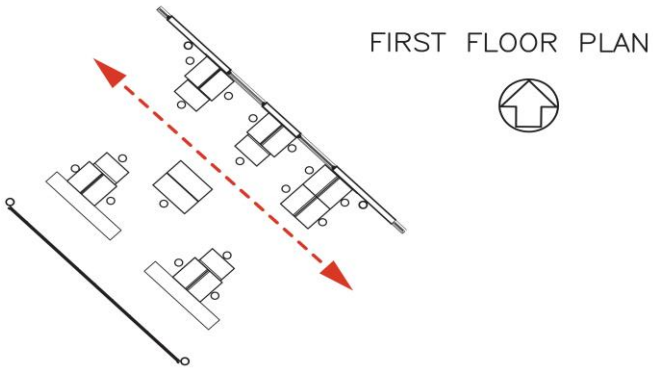


Figure 4. Layout of the AD 1 studio

Open layout and "flow". When asked to describe the physical space of the studio, students overwhelmingly described it as an "open" workspace that encouraged conversation and collaboration. Students described Natalie's studio in particular as having "a channel" between studios that allowed for "flow" between studios. Jon described Natalie's studio as being shaped "like a plus" allowing entry from three of four sides of the space. He explained that students often migrate between Instructor C, Natalie's studio, and Instructor E's; students walk back and forth between studios, "milling around", and instigating conversation through observing others' work. I, too, noticed this flow of students through Natalie's studio by students in other studios as early as the second week of AD 1.

> Students mention that the students in Instructor C's, Natalie's, and Instructor E's studios get along very well. Perhaps this is due to how the studios are physically arranged. There is a clear, open path between the three studios where many students will walk back and forth, checking out each other's' work and stopping to chat. (Field note, 11 September)

This flow of students through the studios was a daily occurrence in AD 1, and although less frequent at first, appeared to happen more frequently as the semester went on. For example, Jon described his behavior as he walked through studios during work time in the early weeks of AD 1.

> *You do an hour of work and then bounce around for 20 minutes and talk to people and see what they're doing. Then go back to work and implement those things or ideas, suggestions, critiques that you've heard from people or seen from people, seen what they're doing. Then you kind of implement that. Then you go back out in the field and you kind of see what people are doing now.* (Jon, 4 September)

Jon's example demonstrates how the open layout of the studio space allowed for students to walk around "in the field", discuss the project with others, and then apply what they learned to their own work in an iterative cycle of process. I observed these same

behaviors by all the students on an hourly, daily, occurrence in AD 1. Brady explained these casual interactions for discussion, observation, comparison, and application for a "flow" of ideas that supported a healthy competition between students in Natalie's studio and the other studios adjacent to it.

> *A flow. There's open gaps and you won't even realize you're in different people's studios. They're just naturally flowing. I think ideas flow a lot better. You should see the ... I mean this new project we're working on now, these site plans…us three [studios] are just flowing! I mean you can see the ideas of how they come looked at ours and we've looked at theirs, developing these ideas that are, like, competitive to each other.* (Brady, 11 November)

For many students, these casual collaborations also helped get to know the other students in the studios; students felt it was easy to make connections with their peers because the space was so open. Jon stated:

> *I think with architecture you need to make connections and in order to make connections you need to be socially open and open minded and [the physical space of the studio is] how this is exemplified. I personally like, it's always fun just walking around checking people.* (John, 9 September)

Open nature and interaction. The open layout of the physical space also allowed for instructors to visit other studios, informally assess students' progress and provide informal feedback. I observed that other AD 1 studio faculty frequently entered Natalie's studio space, most frequently with another AD 1 instructor (Instructor "A"), although other faculty who also enter Natalie's studio space exhibited the same behavior.

> Instructor A enters studio briefly to kind of 'check things out'. Looks over Natalie's shoulder, nods, and leaves. He seems to zoom through studio, checking students' progress at their desks. Stops at [student's] desk for a quick desk crit. (Field note, 9 October)

Students became very familiar with the other studio faculty because of these frequent casual interactions, and regularly sought out feedback and guidance from other studio instructors as well as Natalie. Allison reflected:

> *We would always walk back and forth [between studios]. I saw a lot of people from [Instructor C's] studio coming over and asking Natalie questions all the time. If I needed help with some kind of technological aspect, I would go ask [Instructor A]. Yeah, I like that it's a very open studio.* (Allison, 9 December)

To the students, the openness of the physical space was a pivotal affordance for learning in AD 1. The open nature of the physical space afforded casual interactions and collaborations among students and instructors from different studios. For many students, the circulation of people and informal collaborations they allowed, helped them in their ideation and problem-solving. In fact, Jon felt so strongly that the open layout of the studio aided his learning and personal development that he insisted his future studios should also allow "passage" between studios.

> *[The] layout of the studio is really well done. I want [next semester's studio] to be just like this… I want a central space that allows circulation with desks placed around that allows, that [doesn't] deny passage to the neighboring studios. I will insist on this. If people are trying to make it [closed in], I will get pissed and I'll be like, "No, we need passage."* (Jon, 8 December)

Openness as distraction. Although the open layout of the studio space afforded collaboration and inspiration, the openness could also be a constraint to students learning when the studio became too informal and social. *"The space is open, and we're becoming friends,"* Chris said in September*, "…which is both beneficial and destructive at times; it can be distracting, we lose focus and start talking."* For some students the open layout of the studio was a regular distraction. *"[There were] too many people coming in,"* Kendra complained, "*I just hate it when people talk too much when I'm trying to concentrate."*

Students also felt the open studio layout had a tendency to prioritize collaboration and social interaction over quiet personal work time:

> *Sometimes it's just weird, I don't want to talk to people sometimes, and sometimes I do, and I don't expect people to know when I'm in the mood to talk, but sometimes it's a little annoying because people will come over and be like, "What are you doing?" When you're like, "No, I'm having thoughts right now."* (Raven, 9 October)

The open layout of the studio contributed to the lure of walking around and chatting as a distraction and procrastination mechanism. Tim noticed that his peers that spent too much time socializing during class were also the same people who pulled frequent all-nighters in the studio. *"Sometimes it's annoying, when people are just hanging out, chatting. I get that, that you have to do that, and I do it too, just not all the time,"* he said. For some students, however, the constant distractions of the open space allowed for learning self-management their time and productivity:

> *Definitely the social interactions [can be a distraction]. I feel like I keep those pretty well in check, though. I will take breaks occasionally to talk to people around the studio or I'll go …talk with some friends down [in another studio], whatever. I mean, for the most part, that's not too big of a stretch. That's more of a break from studio. I feel like I do a pretty good job of [monitoring] that* (Peter, 13 November).

The open working and learning spaces of the AD 1 studio environment afforded frequent interactions with other students in AD 1, allowing for students to walk around "in the field", discuss the project with others, and then apply what they learned to their own work in an iterative cycle of process. The open nature also enabled students to visit other sections of AD 1 and to establish relationships with a wider circle of peers and their instructors. However, the open layout could also be a constraint students' behavior; the space was frequently loud and disruptive, and students stated the physical layout prioritized social

interaction over private work time. Despite this, students felt the frequent circulation of people and informal collaborations they allowed helped them in their ideation and problem-solving.

The desk as personal work and exhibition space. Students in AD 1 had individual desks that were dedicated work spaces throughout the semester, and AD 1 was the first semester where architecture students had dedicated desk space in the College. The desks included a surface space where students worked on drawings or models, lockable drawers for supplies, and a vertical portion of the desk behind the table top where students hung drawings and other class-related and personal artifacts.

The desks afforded both personal work space and a personal exhibition space. The desk was a dedicated space where students could work in co-location with their peers yet provided a personal space or "home base" where students could focus and leave their design work uninterrupted as they progressed through a project. The desk also afforded a personal exhibition space where students display their work in progress.

Personal workspace. The desk was conceptualized as a "home away from home" for students; a place where they stored their belongings and worked on their projects uninterrupted. Tim described his desk space as a *"home base"* for his work while in it is in progress, free from disruption:

> *Okay, I guess because you're not worried about sharing space, you have more time to worry about actually developing your own ideas. Versus, it's like, if you're worried about if are you for taking up too much room on a table or something like that, [you're] more distracted.* (Tim, 14 September).

Brady emphasized his desk as a private space where he can focus on his work, especially in the final stages of a project when social interaction isn't an important aspect of the design process. He said:

> *I think in the design process, you need that public interaction, but then when you're finalizing something, you need that more personal, you need that more [private space], so you can actually get work done, and you can think to yourself, quick fixes, that kind of thing.* (Brady, 14 December)

Students also equated the dedicated personal desk space with "belonging" to architecture. John said, *"the fact that you have your own space makes it feel like you're part of this, like [the department] cares about you, and that in itself when someone cares about you, [it] gives you more motivation."* Students felt the architecture department made their work spaces *"comfortable",* with good quality chairs and large desk spaces; *"they make it easy for you to be here; it's a space that's all my own",* Peter told me. Students felt a sense of ownership over their workspaces and this equated with belonging and feeling important to the architecture department.

Exhibition space. The desk space also afforded students' public display of work in progress. As students completed drawings, computer generated images, or iterations of their designs, they displayed them on the vertical portion of their desk for their own reference and as a way to display their progress for others to view. It was expected that students would use their desks as a personal exhibition space for desk crits with Natalie and other AD 1 instructors, so that work could be viewed and easily referenced during feedback. Students also hung their work in progress on the vertical portion of their desks for their own reference as they progressed to see their changes to their designs over time.

> *It's just, it's all there. I have all the components, so if I ever need to go back and look at my first drafts, my first steps of the project, I can be sure it's*

> *always there. I have it pinned up, certain things, and then so if I lose track of where I'm going with an idea, I can find it.* (Raven, 10 September)

Displaying work in progress was also seen as an entrée to starting conversations with peers, especially in the beginning of the studio experience when students were getting to know each other. Jon described how people meet each other through imitating conversations around students' work displayed at their desks:

> *Generally, when you're meeting someone, at least here, it's kind of like, "Hey, I like what you're doing right now. What are you working on?" You start the conversation to meet someone based on what they're working on. It's really easy to just go talk to somebody that you don't even know. Look at their work for ten seconds and then talk to them about it and then meet them ... it's much easier to start a conversation with a complete stranger here. The environment or the atmosphere is very conducive for that.* (Jon, 4 September)

Students also used the personal pin-up space the desks afforded as a way to compare their own progress against their peers. Students regularly mentioned how they would look at the work on the desks of other students and see how they were approaching a design problem, and compare and assess it against their own solutions. For example, Allison judged what she should include in her boards for her final project based on what she saw on her peers' desks as they progressed:

> *When I was putting together the poster, I felt like Instructor E was going to have them have the most rendering and technological stuff, so I was like "Okay. Well, I'm not going to be the worst one in here. I'm going to see what they have, or what he's making them put on their posters, and then judge by that what I should put on mine."* (Allison, 9 December).

Tim mentioned looking at work in progress on his peers' desks and using it as a benchmark against how he should progress. He added:

> *I can see what other people are working on and the drawing that they're making specifically and how they're doing their drawing and that helps me see where I need to go as how I can take what they're doing and make that my own ideas and stuff like that. I don't know. We have to do models as well. I*

> *haven't really started thinking about that, but other people have. It's good seeing how other people are doing their models.* (Tim, 7 October).

The desks afforded both public and personal behaviors. The public/personal nature of students' desks afforded a dedicated work space, a "home base" for students where they could focus on their work and leave their design work uninterrupted as they progressed through a project. The desks also afforded a personal exhibition space where they could display their work in progress for their own reference and to obtain formal and informal feedback from others. The desks also provided an entrée into collaborations among peers and contributed to feelings of ownership and belonging to architecture.

Co-location and working in proximity to others. Students in AD 1 were required to work in the studio space during scheduled class sessions, and it was expected that they work in the studio space outside of class time as well**.** The shared workspace of the studio environment capitalized on co-location and proximity, enabling students to work collaboratively in a shared space and benefit from working in close proximity to others. Throughout AD 1, I observed that students interact more often with peers and instructors that were physically situated close by; where a student was physically located in the studio environment had an effect on the types of feedback they receive, their design actions, and their thinking.

Co-location with peers. Students' co-location with their AD 1 peers was also seen as an affordance, and students took advantage of having their peers close by for sharing ideas and gaining feedback. For example, Tim and Kendra were seated back to back in the center of Natalie's studio. Although they did not know each other before the start of AD 1, they frequently interacted throughout their progress in all three projects, frequently rolling back

and forth in their chairs during studio sessions, consulting with each other and asking for feedback.

> Natalie is at Kendra's desk for a desk crit. Tim is at his desk nearby, rolls his chair over to Natalie and Kendra, phone in hand, listening in on Kendra's crit, watching Natalie give Kendra feedback and drawing on trace over her drawing. Tim has his phone in hand, listening – he's referencing something on his phone while he's listening in, the project handout perhaps? He rolls back to his desk….Ten minutes later he rolls back over to Kendra's desk. He's looking at her sketchbook, talking through ideas of her spatial sequence project (Project 2). He's asking about where she'll place the water, working through other constraints of the project. He rolls back over to his desk, then stands up to draw, draws a bit, then sits and rolls back over to Kendra. "Where are you putting the fire in?" he asks. Then Kendra and Tim talk through the constraints of the project: "where are you going to put that, and that?" Tim then goes back to his desk, standing, drawing. (Field note, 7 October)

This behavior between Tim and Kendra occurred almost daily during the course of AD 1; either Tim or Kendra were listening in to Natalie's desk crits with each other or they rolled back and forth to interact during studio working time. Tim and Kendra frequently compared their work and self-assessed their progress in relation to each other.

> *I find that we have ... we've developed the same sort of process. I mean, we go about things differently honestly and our ideas are very different but the process itself is similar. ... As for myself it's so helpful to have someone that I can talk to that's right there, and I can look at what she's doing and have that conversation about design and stuff like that. That's really helpful, honestly.* (Tim, 11 November)

For Tim and others, working in co-location with their peers afforded the opportunity to compare their progress with others' progress, easily access peers to ask questions, share ideas, and engage in feedback. Brady described working with others in co-location as a giant *"..think tank" ... you come back here and you have all these brains thinking, and I have neighbors right next to me, and you just turn around and be like 'hey, what are you doing?' I like that feel,"* Brady said.

Proximity to other studios. Natalie's studio of AD 1 was also physically close by other sections of AD 1. The open layout of the studio afforded a porous boundary allowing for students and instructors from other sections to frequently interact with students in Natalie's studio. However, for students sitting on the periphery of Natalie's studio, the proximity to other sections afforded more frequent interactions with peers outside their own section and with other instructors. As a result, these students had a wider circle of peers and instructors to gain feedback from multiple perspectives.

Allison's desk was situated on the periphery of Natalie's studio, in the northeast corner of the studio space farthest from the center. As such, her spot was in close proximity to Instructor E's studio space. Although at times she felt "isolated" over in the corner, over the course of the semester she developed relationships with students in Instructor E's studio and with Instructor E himself. *"I liked that,"* she reflected, *"...because then I could kind of see what they were doing."* Allison frequently sought out feedback from Instructor E despite the fact that she was not one of his students. This, in turn, enabled Allison to develop a close relationship with Instructor E:

> *[Instructor E] would come over and help me sometimes or he would see me working and ask. He reviewed me at my interim and then he kind of, once or twice, checked in on me to see how I was progressing. Which I thought was really nice. He didn't have to do that.* (Allison, 9 December)

Other students mentioned the influence of being in proximity to others on their work and learning. I frequently observed students from Instructor C's studio discussing approaches to the projects with Natalie's students, comparing the different approaches advocated by the two instructors. As Brady described, a "friendly rivalry" developed between students in Instructor C's studio and Natalie's studio due to their proximity. Chris

and Peter agreed that their location in the studio, close to Instructor E's students, also helped them form relationships with students and encouraged their motivation. Peter stated, "*Looking at [the other section's] stuff, I was just kind of pushed to do better because all of their stuff just looks incredible*."

Summary

The qualitative characteristics of the physical space of the design studio afford important student learning behaviors. The open layout of the studio spaces in AD 1, combined with the public nature of the desks/workspaces as a space for students to personally exhibit their work in progress, afforded frequent feedback and conversations surrounding the design process. Students equated the "flow" of students and faculty through the studio space, and the social interaction it affords, as an essential part of learning in the studio and their identity as an architecture student. Dedicated desk space affords students the opportunity of uninterrupted production, "pin up" space to reflect on how their work changes over time, and for some, allows a sense of belonging to the architecture department. Students' working in proximity to each other, and to other studios in AD 1, also affords instructor and peer feedback and social interaction; proximity affords students' frequent comparing and self-assessing of their design process against others, monitoring their learning and performance against their peers.

Structural

The structure of the AD 1 studio includes the hours and scheduling of the course, the projects and other learning opportunities and their deadlines, pacing, and sequencing, and the alignment of AD 1 with other courses in the curriculum. Long blocks of studio time, mostly

devoted to students' individual work time, afforded the ability for students to work at their own pace and provided opportunities for them to learn how to self-manage their time and monitor their own progress. Students also felt that long hours of class and personal time in the studio mimics authentic architectural practice. The alignment between AD 1 and the other courses in the curriculum afforded students multiple learning opportunities to build upon and apply their knowledge across all courses, and allowed students to feel that what they are learning across the curriculum is relevant to their development. The 'project brief', a document that outlines the parameters and expectations of the project, afforded an important framing device, and helped students reframe the design problem before entering into a design solution. Finally, the sequencing of the three projects in AD 1, and the sequencing of the tasks and deadlines within the three projects, afforded students to experience the design process in stages and build upon and apply the knowledge gained in the previous project to the subsequent one.

Long blocks of time. AD 1 met on Mondays, Wednesdays, and Fridays from 1:00 pm to 5:20 pm for 15 weeks; approximately 195 hours of course time in total. Many of these hours were dedicated to students' individual work time, when students were free to work on their projects at their own pace. The only scheduled events during Natalie's studio hours were demonstrations or lectures at the beginning of the studio session and scheduled desk crits or reviews. The rest of the time students were free to spend their time as they choose as long as it is related to their studio projects. These long blocks of time afforded students the opportunity to self-manage their time and monitor their own progress.

Self-managing work time. In the early weeks of AD 1, students complained about the long hours they spent in studio. Many felt they were "stuck in the studio" for too long, especially toward the end of the day when they felt "brain dead" and all of their ideas were exhausted. Over time, however, students overcame their feeling of being stuck and learned to self-manage their time and adjust their process according to their own productivity. Students described their daily productivity in blocks of time dispersed by small breaks. For example, Jon described that he works in *"…chunks"* of time: two and a half to three hours, then a break for coffee or lunch, chat with a peer, then back to work. Brady stated he found his own *"flow"* of productivity over the course of the semester:

> *I want to be more focused in, and doing those long class periods, it's going to become more ... The thing is, I like a little bit of interaction like that, but I like the interaction, non-interaction, interaction, non-interaction. I like to get a flow. I like getting a couple hours in working, and then a break.* (Brady, 14 December)

The long blocks of work time afforded students the opportunity to find their own flow of productivity, learning when they were most productive and when they needed a break to recharge.

Managing personal time for work. Students' management of their own work time and productivity also extended to the studio environment outside of class hours. Students would frequently arrive to the studio after their morning class, between 9:00 and 10:00 am each day, and work until lunch at noon, then return for class at 1:00 pm and stay until 5:30 pm. Many equated being in studio from morning until evening as "a normal work day", and felt that keeping long hours in the studio and working at their own pace as authentic to architecture practice. In response to the long hours of studio work time, Tim reflected, *"I started noticing that it's like a full time job for me,"* and Raven said, *"I think it's a good*

exposure to how it's probably going to be when you work for a firm." Students felt that learning to become self-regulated and managing your own productivity is critical to becoming a successful architect.

> *[Studio is] very laid back and, kind of, go at your own pace. In a lot of ways, it's up to you what you get done and when. Obviously, there are deadlines, but how you meet those deadlines and how you prepare for those deadlines is largely up to you, which, I don't know, can really hurt you. I mean, that's how it's going to work in the real world, so you may as well get used to it now.* (Peter, 13 November)

Alignment with other architecture courses. Students in AD 1 were concurrently enrolled in a design communications course, a building science and technology course, and an architectural history course as well as AD 1. The courses and their respective assignments were highly aligned at the beginning of the semester and slowly faded in alignment over the course of the semester. For students, this horizontal alignment between AD 1 and other courses in the curriculum afforded multiple learning opportunities to build upon and apply their knowledge across courses and allowed students to feel that what they are learning is relevant to their development.

Curricular alignment. The alignment among courses across the curriculum was explicit earlier in the semester and lessened as AD 1 progressed through the semester. For example, when students learned about sun path analysis and diagramming in their building science and technology course, they were expected to add this analysis to their presentations for Project 1 in AD 1. Tim explained how this alignment benefited his studio projects in AD 1:

> *That overlap between the classes is really nice, because it's like the concepts we're learning in [design communications] and [the building sciences and technology course] can be directly applied to what we're doing in [AD 1]. I*

> *really like that structure honestly… I can, like, the concepts that we're learning can be directly applied to the projects that we're working on.* (Tim, September)

The alignment between the courses in Project 1 helped students make connections in their understanding of design representations and how they communicate design ideas externally. For example, Raven explained that learning how to do elevation drawings in her building communication class helps her to understand the role of elevations in architectural design:

> *For the next step of this project we're doing elevations of the building. We're doing that in our technology class a little bit, kind of working at those. Those line up, I mean, I think it's important to be learning all of that together because…everything comes together at the end. It's important…. I understand what an elevation should be [in studio] based on what we're doing in [design communications]. We're doing elevations right now. I understand kind of the standards that they want, the detail that they want in elevations.* (Raven, 2 September)

Allison mentioned how the curricular alignment helped her *"make connections"* between her learning across the courses, making it easier to learn by staying focused. She added:

> *I like that [all the courses] relate to each other in the material. I just feel like it makes it easier for me to learn, because I'm seeing it all day in all my classes. I'm not distracted by other coursework that has nothing to do with it.... I'm learning how to do the computer communication type stuff, and how to make [floor] plans, and then in [AD 1] I have to analyze the plans, so now I can read a plan better. It's really helpful, because before it was like a foreign language. We've only been doing it for a week, not that I can go about reading plans. But just what we've done so far has been really helpful, because it's all architecture work.* (Allison, 2 September)

The curriculum became less aligned midway through AD 1. Even when course content didn't directly relate, students still understood that the knowledge they were gaining in their other courses was meaningful and will be useful to them at some point in the near

future. For example, Kendra felt that what she was learning in her other courses would be useful to her later, and learning it early in the semester will help her feel more prepared when the projects became more complicated:

> *The [building communications course] and [building science and technology course] really help me. For example, even though we haven't been asked to build a building yet, I'm pretty sure for the coming project we are going to have to make a building. It's going to help me in deciding the openings or what not. We are currently studying about energy, sunlight, and stuff like that. For [building communications], it would be a lot, even though there's a lot of stuff to learn about, it's going to help you in translating your design to the computer because I am new to stuff like that.* (Kendra, 2 September)

By Project 3, there was little to no alignment among the courses which was also an affordance. At the later point in the semester many students felt the lack of alignment between the courses and the projects associated with them provided a much-needed break from their work in AD 1. *"I feel like everything is separate right now; I kind of like it,"* Peter said, *"...because it gives you a break from things. I'm already looking at this model and this stuff a lot, it's kind of nice to just have a change of pace."* Toward the end of AD 1, students also recognized for themselves how the learning from their other courses aligns or does not align with their learning in AD 1. For example, a few students felt that learning about fundamental elements of structural engineering in their science and technology course earlier in the semester would have helped them prepare for Project 2. In this way, the lack of alignment between the courses later in the semester brought students greater awareness of the gaps in their knowledge.

Negative affordances of alignment. The alignment between AD 1 and other courses in the curriculum also had negative affordances or constraints. Students reflected the alignment felt "forced" at times and put unnecessary constraints on their work; for instance,

the requirement to add sun shading devices to Project 2 due to the emphasis on sun path analysis in another course. In addition, many deadlines for project work in the other courses overlapped with deadlines in AD 1 and students encountered difficulty in managing the work for both projects at the same time. As a result, students tended to prioritize their studio work over their other course work.

Despite the constraints, the alignment of course content and project sequencing between AD 1 and the other courses in the curriculum afforded students the opportunity to apply what they are learning in these supplemental courses to their learning in AD 1, resulting in many opportunities for students to build upon and apply their knowledge across the curriculum and contributed to students' feeling of relevancy and engagement in the course content.

The project brief as a framing device. Each project in AD 1 was presented in a "project brief". The project brief is a document that summarizes the project overview, the learning objectives of the project, definitions of terminology integral to the project, identification of architectural precedents that may guide the project, the sequence of activities and their corresponding deadlines, the "program" or a list of the client's (or project's) requirements, and any project constraints. The students' final designs were considered as responses to the project brief. A students' performance on the project was evaluated against the project brief, and students were expected to address how their design meets the requirements outlined in the brief.

Students in AD 1 commonly referred to the project brief when they were "stuck" with a design problem. I wrote in my field notes:

> I walk over to Allison and she mentions she's "stuck". Her solution is to write her ideas down, stream of conscious style, as she re-reads the project brief… As she writes, she looks across to see how her ideas align with the project brief. We talk about thinking about the bigger picture – what the end goal is, starting with the bigger picture idea then working in the details. (Field note, 7 October)

Allison's strategy to get out of being "stuck" was to inventory her ideas and check them against the brief. Other students also checked their work against the project brief as they move forward with the project; "check the brief!" was a common answer from peers when students have questions about aspects of the project. The brief communicated the desired learning goals of the project, with specifications that provide a set of working principles to guide students through the project, yet it was written in a way that was open enough to inspire ideas. In this way, the project brief acted as a framing device; a lens through which to 'see' the problem and visualize different design solutions.

Project constraints. Project constraints were also included in the AD 1 project briefs. For example, the constraints outlined in the Project 1 brief were:

1. The shell must enclose a volume of 8000 cubic feet, with the following restrictions:
   - can be a cube 20′ x 20′ x 20′;
   - can be a rectangular volume employing dimensional increments of minimum 10′ on any given side, provided that the overall interior volume remains 8000 cubic feet, and that each surface plane remains 400 square feet (10′ high and 40′ wide/40′ high and 10′ wide by 20′ deep);
   - only rectilinear geometries are permitted to contain the volume.
2. The wall plane can extend 1′ out from the "zero" plane or retract 1' deep: giving a maximum 2′ deep dimension (that is screens, shades, deep windows etc. can occupy a thickness of 2′ max from inside to outside. This potential may be used to consider the way in which the walls touch the ground plane.
3. Each façade of the cube is to have different ratios of open to closed conditions as follows:
   - one wall plane is to have 20% openings 80% opaque conditions;
   - the adjacent wall plane is to have 40% openings to 60% opaque conditions;
   - the adjacent wall plane is to have 60% openings to 40% opaque conditions;

- the final wall plane (also adjacent to the first) is to have 80% openings to 20% opaque conditions;
- you may also elect to place a single opening on the roof, not to exceed 10% of the total surface area of that surface plane;
- screens/shading devices, etc. can be place overtop of either open or opaque conditions and do not affect the percentages listed above. (Artifact, Project 1 Brief)

Project 1 had the most detailed constraints while project 2 had less constraints. Many of the constraints in Project 3 were dictated by the project site chosen by the student or self-imposed based on the 'client' they've created for their project.

When students were evaluating their design decisions against the project brief, they most commonly referred to the constraints as a set of standards to evaluate the design solution against. For example, I observed Allison critiqued Brady's design for Project 2 against the project constraints:

> Allison gets up from her desk to talk over to talk with Brady. Brady is showing her his sketchbook, talking through his design. Allison is giving him feedback on his iterations, sketches, ideas. "Aren't there requirements of what the model should be?" she asks, meaning there are project constraints on the size, number of trees, etc. "I feel like Natalie is going to make you change this [to be more in line with the project constraints]" Allison says. Regardless, she compliments his ideas. "That's the first time someone has complemented my idea; [everyone else] makes me change it," he tells me. (Field note, 7 October)

Students were also instructed to justify their design decisions by specifically referencing the project constraints. Students and faculty referred to the project brief during critiques and reviews, particularly final reviews. It was expected that reviewers had read the project brief prior to review, or at least have an understanding of what the brief contained. During the reviews, critics referred to the brief and asked students to comment on how their design solution met the requirements of the project within the given project constraints.

Although students in AD 1 complained about the restrictions these constraints put on their projects, they also realized that the constraints afforded greater creativity for their

design solutions. For example, Tim reflected that his downtown residence project had many site constraints, and felt the constraints fueled his ideas.

> *I was really excited that I got that spot, because I wanted the most constraints. I feel like in my own work I want to limit myself. That way I can expand, go beyond what expectations are in a very small area, or something like that. I was excited about the constraints, and I knew that I wanted [the design to feel] open.* (Tim, 7 December)

John remarked that project constraints acted as a catalyst for his creativity in the early phases of a design's development. He stated:

> *Having constraints develops a skill in terms of being able to deal with [them]; being able to make something that fits within the constraints. Remember, I said it goes faster when you have constraints because you have somewhere to start from; that in of itself because you have a beginning. Not having any constraints means that you don't have a place to start from.* (John, 14 October)

Thus, the constraints served as a mental frame through which he could view the design "problem", and problem solve within these limitations quickly to ideate and test solutions to the problem in the early stages of the design.

Competing interpretations of the brief. Although all of the AD 1 studios worked from the same project brief for each project, each studio instructor interpreted the brief in their own way, which caused confusion among AD 1 students when they communicated about the project with peers across the different sections. This constraint was particularly evident in how closely each instructor expected their own students to adhere to the project constraints. For instance, students felt that Natalie was "lenient" when it came to adhering to the project constraints; "she doesn't hold them against you", said Brady, while students in other sections were expected to adhere more closely to the brief and the constraints. This led

to tension between students when they evaluated their work against their peers' in other sections and offered critique.

Project sequencing, pacing, and the "staging" of the design process. Finally, the sequencing of the three projects in AD 1, and the sequencing of the tasks and deadlines within the three projects started to make sense. The process enabled the students to experience the design process in stages and build upon and apply the knowledge gained in the previous project to the subsequent project.

Project sequencing. The three projects in AD 1 were designed to build sequentially on each other to allow the learning of façade and spatial conditions from Projects 1 and 2 to designs in Project 3. Students learned about architectural elements and design strategies and spatial conditions in low investment, smaller scale projects before delving into the design of an 'actual' building. "Otherwise", Natalie said*, "…students would just design a collection of rooms"* rather than designing for space and form.

At first, students had trouble seeing the relationship between the learning in each of the projects and why they were sequenced in this manner. To them, the projects felt like three separate entities. By the time students started Project 3, however, they began to understand the logic of the project sequencing. For example, Jon referred to Project 1 as the *"…Gateway Project … [Project 1 was] like the gateway into what we are going to learn next. Like façade…then comes site, and incorporated with that was façade. Then comes whatever's next",* he reflected. Tim also understood the logical sequence to the projects as building upon his learning as he progressed through the semester:

> *I've noticed that I myself have had to move away from thinking about my project aesthetically and thinking about [how] this space works. I understand*

> *why we did [Project 2], and I understand ... I guess it's like it was the smallest project so it was the least important of our projects. But I like how we moved from that to thinking only about space, so we were only thinking about façade and then only about space and now we're thinking about it all together… like how it's built up because you know we were only focusing certain aspects of the first two projects and now we have to focus on them all. We sort of have an understanding about that too. It works well I think.* (Tim, 11 November)

By the time students were working on Project 3, the Downtown Residence project, they understood how the learning experiences afforded by Projects 1 and 2 allowed them to transfer what they've learned about space and form to the design of a building. Raven explained how this *"…building up"* of the learning through the sequencing of the projects helped her in Project 3:

> *For project 1, also, it was just like the skin of the building, which is a good starting point, because if you had given me Project 3 at the beginning of the semester, it would have been crap. I just didn't know enough about programs, organizing buildings and stuff. It would have been just like "Here's my rectangular outline ... "Yeah. I definitely didn't know enough. I didn't know enough about facades. So [projects] 1 and 2 were good learning experiences... I definitely appreciated the information when we got into Project 3.* (Raven, 9 December)

The way the projects were linked sequentially in AD 1 afforded the cyclical learning of specific architectural techniques and skills that were directly applied to the next project; the sequencing of the projects afforded students opportunities for comprehension and skill acquisition that were then immediately applied to the next project.

Sequencing of tasks and deadlines. Another affordance was the sequencing of the tasks and deadlines within the three projects which enabled students to experience and apply the design process in stages. The nature of the assigned tasks and their within-project deadlines were fast-paced and highly structured in the beginning of the semester, with a gradual release toward the end of the semester. This high- to low-scaffolding in terms of

tasks and deadlines emphasized productivity and rapid iteration and decision-making in the design process.

The tasks within each project were sequenced in a way that broke the project down into stages and its constituent activities, and utilized the learning from the previous stage in subsequent activities. For example, in AD 1 Project 1 had three stages entitled: (1) "Extrapolate;" (2) "Iterate and Create;" and (3) "Reflect, Refine, and Redraw." In the "Extrapolate" stage, students were required to examine architectural precedents and identify design strategies present in the façade to create a 11X 17 montage that emphases these qualities. In the next stage, "Iterate and Create", students developed a new iterations of the previous montage in a smaller format, then translate the montage into the design of a façade for a building housing an exhibition space within strict parameters. In stage 3, "Reflect, Refine, and Redraw", students translated their façade designs into architectural renderings of their building designs in elevation and section drawings and a 3D model. These stages were intended to mimic the architectural design process, involving different types of thinking and methods at various stages of a design project. This sequencing enabled students to learn how to manage their design project effectively while experiencing the stages of design thinking and process.

Project 1, with its structured staging and tasks, was the most highly structured of the three projects. Project 2 was less structured, and Project 3 was the least structured of the projects. By Project 3, students were required to create their own "working plan", establishing their own staging, tasks and deadlines. The learning tasks moved students progressively toward independence, and the structure gradually faded to the point of shifting the responsibility of the learning process over to the student by Project 3.

Project pacing. The pace of the assignments and deadlines within each project was determined by the overall length of the project. Project 1 was approximately one month in length (August 24 - September 23). Within this month, students were expected to have a task or stage of the project completed almost every class period, with weekly "hard" deadlines including the final for the project. Project 2 was quickly paced, a little less than one month in length (September 23 – October 16), with multiple tasks, stages and deadlines each week. Project 3 was the longest of the projects at two months in length (October 16 – December 7) which allowed for a slower pace; students were largely responsible for setting their own sequence and pace for deadlines in Project 3 as long as they are prepared for the interim and final reviews for the project.

The quick pace of the projects and their deadlines afforded rapid iteration and decision-making, and allowed projects to move forward through repeated iterative cycles and incremental growth. Students mentioned the quick pace of the deadlines in Project 1 and 2 taught them how to "think fast", in order to "pump out ideas" and "keep working and keep designing", and "keep producing". The quick pace emphasized rapid production of ideas and solutions and afforded timely feedback for refinement and progress in the design. For example, both Jon and Brady explained how the rapid pace of the projects afforded time pressures that kept them working and refining ideas.

> *Just keep working. Just keep plugging along ... Don't sit down and start worrying….You got to just kind of push worry to the back of your mind and just keep working and keep designing. Especially when there are a lot of deadlines and a lot of work for that deadline.* (Jon, 4 September)

> *[The quick pace] makes you sit down and really push yourself to pump ideas out, which is good and bad….I'm pretty good at putting pressure myself but [deadlines] add more pressure automatically….For example, I sat there, like the first day, I just started drawing like being 5 or 6 pages increased to 10.*

> *You're pushed for time to get these ideas pumped out. You're sitting there developing really quickly. I think that's the good news of these fast timelines* (Brady, 23 October).

Students recognized the smaller, incremental deadlines within the projects pushed them to "have a product" at each stage, breaking the project up into smaller pieces in order to get everything done by the final deadline. Tim noted:

> *I think the schedule is the main pressure; just having … It's by a certain date, I have to have a product. I just have to work as much, as long as I have to, to have a product by that date. It's like there's less time to do other things, but at the same time, it's like, I know that, it's the pace that has to be for us to get everything done.* (Tim, 14 September)

Sequencing and pacing as a hindrance. Although the sequencing and pacing of the project deadlines, along with unscheduled work time, was intended to help students develop their own project and time management skills, this was not always successful. For some students, "long deadlines", or longer amounts of time between deadlines and the lack of assigned tasks for each deadline, were a constraint if students were not conditioned to setting self-imposed deadlines. Chris said:

> *I know [Natalie] wanted us to come up with our own schedule or plan of what we needed to get done, [but] I feel like there should already be something like that, what we need to get done. I know professionally, you have one deadline and you'll have to ... but I feel like in school…I'm used to teachers having schedules laid out for you.* (Chris, 11 November)

Others stated that the lack of deadlines and structured tasks, and self-imposed deadlines, took away the "immediate threat" and pressure to get work done, leading to procrastination. Jon noted:

> *[Studio] was bit unscheduled like that we didn't have that many deadlines. We were accepted to set our own deadlines and that's not how it works with me, because I cannot do [time or project management] plans, I've never done plans before. Well I have I just never followed, I never end up following them,*

> *because like there's no like immediate sense of the threat or you know what I mean? I need to like feel it, the pressure.* (John, 15 December)

The sequencing of the three projects in AD 1 afforded the cyclical learning of specific architectural techniques and skills that were directly applied to the next project. The sequencing of the tasks within the projects, and the deadlines and pacing of these tasks, allowed students to experience and apply the design process in stages. The high- to low-scaffolding of tasks and deadlines emphasized productivity and rapid iteration and decision-making in the design process.

Summary

The structure of AD 1 as a class allowed for long blocks of unscheduled work time where students were free to work on their projects at their own pace. These long, unscheduled and unscheduled blocks of time afforded students the opportunity to self-manage their time and monitor their own progress. Over time, students also felt that long hours of unscheduled work time in the studio mimicked authentic architectural practice. The horizontal alignment between AD 1 and other courses in the first-year curriculum afforded multiple learning opportunities to build upon and apply their knowledge across courses and allowed students to feel that what they are learning is relevant to their development as architects. The project brief afforded a framing device, or a lens through which to 'see' the problem and visualize different design solutions, and a guide to evaluate solutions to determine their value, while the project constraints offered limitations on options and acted as a catalyst for ideas. Finally, the sequencing of the three projects in AD 1 afforded the cyclical learning of specific architectural techniques and skills that were directly applied to the next project, and sequencing of the tasks and deadlines within the projects, allowed

students to experience the design process in stages, and emphasized productivity, rapid iteration and decision-making.

Pedagogical

The pedagogy, or the method and practice of instruction, in AD 1 predominantly centered around the use of critique in various forms: desk crits, pin-ups, interim and final reviews, and peer-led reviews. Other pedagogical methods and practices included mini-lectures and demonstrations. Frequent informal critique in the form of desk crits and pin-ups afforded the transmission of tacit design knowledge through reciprocal showing and telling. Formal critiques, or reviews, afforded students to rehearse or perform the oral, visual, and written transmission of their architectural knowledge to others. Mini-lectures afforded psychologically bringing students into the learning environment of the course, and allowed for opportunities to address questions or concerns in a whole-group context. Demonstrations afforded the modeling of design thinking, making procedural knowledge visible, for students to observe.

Critique

Critiques were the central pedagogical feature of AD 1. Students' daily activities in the studio were scheduled around individual desk critiques with Natalie or other studio faculty. Weekly or bi-weekly schedules pivot around group pin-ups, and project timelines are punctuated by interim and final reviews. Frequent informal critique in the form of desk crits and pin-ups afforded the transmission of tacit design knowledge through reciprocal showing and telling. Formal critiques, or reviews, afforded students to rehearse or perform the oral, visual, and written transmission of their architectural knowledge to others.

Informal critiques: Showing and telling. Two informal critique interactions present in AD 1, the desk crit and the pin up**,** afforded pedagogical spaces where design knowledge was passed from the instructor to student through simultaneous showing and telling, modeling of effective critique dialogue by the instructor and allowed students to rehearse the language of architectural practice. Pin ups had the added affordance of the public display of students' wrestling with design problems.

Desk crits and individual coaching. The majority of Natalie's time in studio was devoted to conducting individual desk crits with students, spending 20-30 minutes with each student each class session. In a typical desk crit, a student's design in its current state was displayed on their desk, the student expressed an evaluative judgment on the current state of the design and their process, and Natalie engaged in investigative questioning to understand the student's design choices and provoke the student into explaining their rationale. Natalie then offered direct recommendations for improving the design, through both explaining the solutions verbally and drawing the solutions directly onto the student's work or trace paper which was laid over the drawings.

Through these interactions, the desk crit afforded a pedagogical space where tacit design knowledge was passed from the instructor to the student through showing and telling. Natalie made her design thinking visible through both drawing and talking simultaneously. Students and their instructors in AD 1 engaged in conversation about design, and engage in the act of designing, at the same time. This reciprocal showing and telling allowed for students to gain understanding through individually-guided design practice.

Students in AD 1 reported that listening to their instructors, and watching their instructors demonstrate the act of designing helped them learn. With enough guidance,

students learned to listen to their own intuition and way of knowing, ultimately deciding when they needed the guidance of an individual desk crit with Natalie and when they did not. Tim reflected:

> *I decided to like speak to Natalie less and just focus on what I'm doing more. That way, like, I'm getting less feedback in class because of the way I'm choosing to work. ...I prefer to stick with my own idea and really develop my own idea versus trying to make changes according to what Natalie prefers. Because I know, that like she's my instructor but still it's like her opinions versus my opinions. So it's like I can do things my way and still be successful.* (Tim, 11 November)

Tim also mentioned relying on his "own idea" with the confidence that his intuitive knowing will be successful. By Project 3 students learned to rely on their own judgement and intuition for wanting the design to "be their own". Showing ownership and agency over their final product means relying less on Natalie's guidance and trusting that they know what they need to do to be successful.

Pin-ups, modeling, and demonstrating dialogue. In AD 1 pin-ups were treated as "group desk crit", where multiple students listened in on a critique, or take the role in critiquing their peer, in a group setting. Natalie scheduled informal pin-ups at various points in AD 1 when she felt many students were struggling with the same problem. Pin ups afforded the modeling of effective critique dialogue by the instructor and gave students a chance to rehearse the language of critiquing architectural work.

In a typical pin-up critique, Natalie asked her students to hang (or "pin up") their drawings and framed the design problem to the group. Natalie then critiqued the first student, drawing and explaining at the same time, and engaging in individually-guided practice with the student. Other students listened in on the critique, watching, listening, while some asked questions. Natalie spoke directly to the student being critiqued but also to

the audience of the student's peers. In this way, Natalie's pin up afforded an opportunity for Natalie to offer guidance to an individual student while modeling and demonstrating the language and activity of critique to all of her students.

After she modeled the critique activity, Natalie asked another student to lead the next critique of their peer. She explained, *"Participation is key; if you can critique someone else's work, analyze it, you can analyze your own work."* Natalie coached the students how to engage in critique dialogue while allowing them and others to take the lead on the critique. The pin-up space, with demonstrating and imitating, telling, listening, and retelling, afforded a group setting for students to rehearse the dialogue of critique while gaining formative feedback on their work by their peers.

Another affordance of the pin up was the opportunity for students to witness how others wrestle with design problems through listening in on and participating in his peers' critiques. Listening in on other's critiques in the pin-up affords a vicarious learning experience; through witnessing the critique and taking part in a discussion about others' performance, students learn what actions and interactions would help them be successful with their own tasks. In this way, the pin-up affords a kind of mini-lecture, or a demonstration with a peer being used as an illustrative case. Peter noted:

> *[With a pin up] you're more having a conversation the entire time which I feel is forcing you to really understand other people's projects and to understand your own. You're just getting that kind of second-hand experience by listening to [the instructor] talk about all these other projects. Which I think is really beneficial because I would love it if I could look at a building and understand what that building is about, what they're trying to convey which I could guess, but I don't really know... That's kind of how I like to learn.* (Peter, 11 December)

Formal critiques: Interim and final reviews. Interim and final reviews are formal critique interactions and have a different set of affordances. Formal reviews and critiques afford feedback on the presentation of a finalized design, and as such, they are focused on the outcome of a design solution more so than the process of designing. Interim reviews afford a 'formal-formative' assessment; they afford the formality of a final review yet feedback is formative, positioned so that students can still make necessary improvements before the final assessment. The final reviews, on the other hand, provide an opportunity for students to rehearse the performance of communicating architecture, taking the audience on "the tour" of students' final architectural design.

Interim reviews and formal-formative assessment. There was one interim review in AD 1 during Project 3, "Downtown Residence". Natalie scheduled a formal interim review approximately half-way through the project since Project 3 was the longest and most comprehensive project in AD 1. The interim review was a "formal" review, where students had to prepare a presentation and present to a panel of instructors, although their projects were not yet complete. As such, students oriented their work, and the discussion of their designs, toward the end result, yet feedback from instructors was positioned toward necessary changes to a project before the final assessment. This "formal-formative" assessment of the interim review afforded students to orient their productivity and work with the end in mind and a "dress rehearsal" for the final review.

By the time interim review was held during Project 3, students were orienting their design process toward their final designs. Students prepared presentation 'boards' or large layouts that included all of the documents required by the project brief (e.g., site analysis, program, and drawings, and a brief narrative) for the interim review similar to the boards

they would prepare for the final. Students' presentation of their projects in the interim reviews were also timed; in some cases, students only had three minutes to explain their projects. Instructor critique was focused on students' presentation of their designs rather than the conceptual idea or process of designing, with the emphasis being on the alignment between the verbal explanation and the visual imagery. *"Anytime you talk about something, you need visuals to be able to claim it,"* as one instructor told Jon during his interim review for Project 3. These strategies oriented students thinking toward the end product; identifying the representations they needed to both fulfill the project requirements and to communicate their design quickly and effectively.

Students in AD 1 referred to the interim review as a "dry run" for the final review, explaining they had to be "just as prepared" for the interim review as they would for the final, or at the very least have a formalized concept and program for their design. As a result, the interim reviews afforded pedagogical space for feedback and guidance specifically on how students should strategically proceed before a final, formal project assessment. The interim review also afforded feedback form other professors that were not as familiar with the project or students' design solutions, allowing students to see how others perceived their designs. Peter noted:

> *Yeah, just to get a different view other than your instructor on what you're doing and it allows you, if you have more final work prepared, it really gives you a chance to present it, get comfortable with presenting it, and then it's really helpful to be able to see what went right, what went wrong, what the instructors liked, what they didn't, and then you get the opportunity to make those changes and hopefully the [final] goes way better.* (Peter, 13 November)

The performance and ritual of final review. The final reviews were public, formal events in AD 1, held in public spaces with audiences of consisting of reviewers, peers, and in

some cases, members of the wider departmental or College community. There was a final review held for each of the three projects. Students presented their projects individually (or in the case of Project 1, in teams) to other architecture faculty or professionals for the finals in Projects 1 and 3. The final review afforded an opportunity for students to learn how to "sell" their design, and to practice the language and discourse in what students' perceive as authentic actions of "being in architecture." The final reviews for Project 2, on the other hand, were juried by upper-level architecture students. The peer-led final review afforded an opportunity for upper-level students to leverage their positionality as peers to provide metacognitive feedback and reflection on process.

All final reviews in AD 1 were formal, structured events; the final reviews were publicized throughout the College, students dressed in more formal or 'business' clothing, and many rehearsed their presentations to Natalie or their peers prior to the reviews. The panel for the final reviews were other architecture faculty, or in the case of Project 3, visiting professional architects. Each student presented their work to the panel, explaining their project for approximately 3-5 minutes, then fielding questions and critique from the panel for approximately 20 minutes.

Each final review followed a similar format. First, students presented their design to the panel by briefly discussing their conceptual process followed by a 'tour' of their solution, referencing various architectural renderings as they explained their solutions. The panel then attempted to understand how the student framed the design problem through investigative questioning and interpretive feedback. Next, the panel offered feedback that was evaluative and judgmental in tone, focusing on how the design was presented rather than the design concept. Direct recommendations of changes to improve the final design or students' design

process were also offered, despite the review being a final, summative evaluation. In these ways, the final critique afforded similar learning opportunities to critique in other forms in AD 1. However, in the final reviews the panel also offered identity-invoking feedback which encouraged students to reflect on their behaviors, values, and attitudes as novice architects.

The final review also afforded an opportunity for students to learn how to "sell" their design. For students, this meant that the goal of their final review presentation was to convince audiences their approach to the design brief "worked" and was the most effective and creative design solution. Many students felt that presenting their work successfully was just as important than the quality of the design itself. Tim noted:

> *I think that even if the project isn't that strong, it's like it matters more about how you present it. Because if like, you can have a good project but not communicate it well, you know, or a really terrible project but you communicate it really well. That's why in my work process I focus on the final product.* (Tim, 11 November)

In fact, a few students equated their role as novice architects with learning how to "sell their design" concept and product, and present their ideas in a way that will help them "win over" clients in their future careers as architects. *"Presentation is how you make the money. [If] you don't present well, how do you expect to sell [your design]?"* Brady said. In this way, the final review afforded the opportunity for students to practice the performance of selling their designs, and gain feedback on their performance, learning how to structure their presentations for the most impact.

Affordances of the peer-led final. Third and fourth-year architecture students led the final review for Project 2 in AD 1, and as such, allowed for a different set of affordances. First, the upper-level students strongly felt they knew what critique format and processes resulted in the best feedback for lower-level students because they had been in the same

situations very recently. For example, feedback from the upper-level peers in the final reviews for Project 2 was predominantly declarative and judgmental. The lower-level architecture students craved judgmental feedback; students wanted to know what they were doing right and wrong. The upper-level students knew this from personal experience, and were able to remember what type of feedback they also wanted during their first architecture courses. Secondly, the peer reviewers observed students struggling with discerning between "draft" and "process", meaning there are different approaches to changing a design at different stages of the design process, i.e., early stages are largely iterative and repetitive, and in later stages, changes to the design are incremental. For example, when the upper-level students were critiquing Brady's final for Project 2 they commented positively on changes made in the early stages of his project, but felt he lost his "big idea" in later changes to the design. The peer reviewers, having also struggled with this distinction not long ago, utilized their positionality as peers to provide feedback and reflection on process.

Summary. Critique, both formal and informal, afford learning and interaction in different ways. Informal critiques, such as desk crits and pin-ups, allowed for reflection, iteration, and exploration. Pin-ups held the added affordance of vicarious experience as well as the public coaching, demonstrating, and modeling for students to learn the practice of critique dialogue. Formal critiques, focused on presentation and external communication, afforded a space for professional communication and practicing the dialogue of architectural practice. The interim review afforded formal-formative feedback; students were focused on the end product, but gained feedback on targeted areas that need improvement before the final review. The final review afforded the performance of "selling" their design to external

audiences, while peer-led final reviews afforded direct and judgmental feedback, and encouraged metacognition and reflection on process.

Mini-lectures and demonstrations

Critique was the central pedagogical element of AD 1, but other pedagogical affordances of AD 1 included mini-lectures and demonstrations. Natalie held mini-lectures, short group discussions or demonstrations, at the beginning of studio for 15-20 minutes. These discussions included outlining the day's agenda, addressing issues or problems she noticed across all of the students' work or progress, or short demonstrations on a particular design or rendering technique. These mini-lecture "pep talks" at the beginning of studio afforded psychologically bringing students into the learning environment of the course, and allowed for opportunities to address questions or concerns in a whole-group context. Demonstrations, with Natalie or other AD 1 instructors afforded the modeling of design thinking, making their procedural knowledge visible, for students to observe.

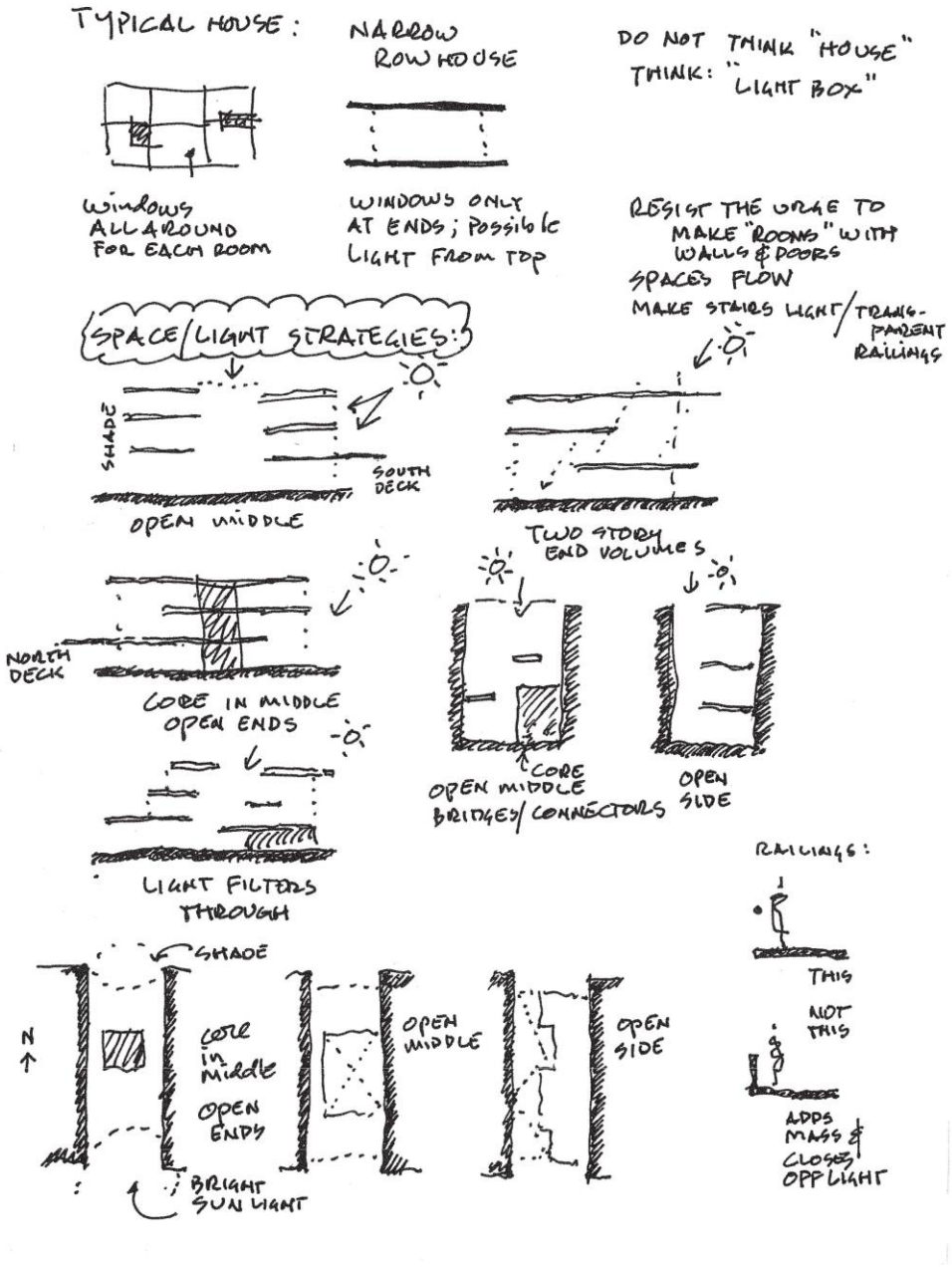
Modeling design thinking. In one example, Natalie asked Instructor E to come into her studio to give a mini-lecture on space analysis and programming for Project 3, the Downtown Residence project. Instructor E is a veteran instructor and practicing architect for over 40 years, and has won many awards for his teaching, practice, and service to the profession. In his mini-lecture, Instructor E simultaneously demonstrated how light enters narrow spaces through showing and telling with the goal of trying to get students to move away from designing rooms to designing for experiences, as a way of re-framing the design problem, as illustrated in Figures 4 and 5.

For example, Instructor E told the students, “Don’t think ‘house’, think ‘light box’.” It is a dwelling within the light” as he walked students through the design strategies for space and light. He talked through considerations of placing dwelling spaces within this “light box”, drawing how light bounces through a narrow space (Figure 4).

Instructor E also addressed how students should be framing the design problem at that particular stage of the project. “You need to create a space for existence. Don’t focus on rooms, walls, doors – not yet. Focus on the verbs of life that support action.” As he spoke, he drew a diagram for analysis as “programming tools” (Figure 5).

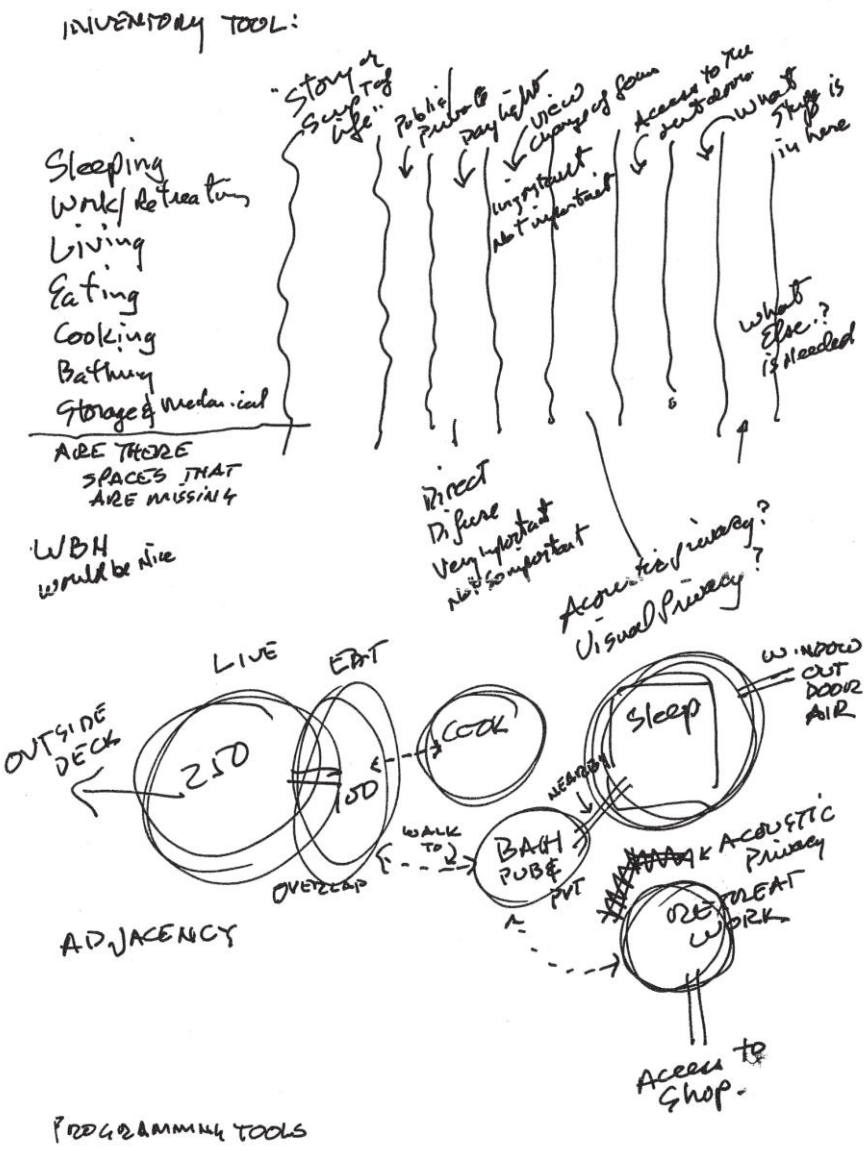
Like the desk crit, Instructor E’s mini-lecture and demonstration afforded two behaviors: showing and telling; through the showing and telling Instructor E made his design thinking visible for the students to see and emulate. First, he showed students how to solve the problem of bringing light into the in-fill housing. He did this by showing students how to think, by drawing images of how space and light interact and referencing narrow, in-fill housing precedents, and diagramming strategies. He also told students how they should be framing the design problem *(“Don’t think ‘house’, think ‘light box’ and ‘focus on the verbs of life”).* On this latter point, Instructor E was walking students through his thinking by making his own cognitive processes visible; his mini-lecture afforded a space where students are witness not only to the act of designing but also the habits of mind of the designer.

Summary. Critiques were the central pedagogical feature of AD 1. Critique, both formal and informal, afford learning and interaction in different ways. Frequent informal critique in the form of desk crits and pin-ups afforded the transmission of tacit design knowledge through reciprocal showing and telling and allowed for reflection, iteration, and



Drawings from Instructor E's mini-lecture on re-framing the design problem for natural lighting strategies for infill housing for Project 3.

Figure 4. "Light box" drawings



Drawings from Instructor E's mini-lecture on program analysis for Project 3.

Figure 5. "Programming tools"

exploration. Pin-ups held the added affordance of learning through vicarious experience as well as the coaching, demonstrating, and modeling for students to learn the practice of critiquing. Formal critiques, focused on presentation and external communication, afforded a space for professional communication and practicing the dialogue of architectural practice. The interim review afforded formal-formative feedback; students were focused on the end product, but gained feedback on targeted areas that need improvement before the final review. The final review afforded the performance of "selling" their design to external audiences, while peer-led final reviews afforded direct and judgmental feedback, and encouraged reflection on process. Mini-lectures and demonstrations also afforded bringing students psychologically into the learning environment of the course, and allowed for opportunities to address questions or concerns in a whole-group context. Demonstrations, with Natalie or other AD 1 instructors afforded the modeling of design thinking, making their procedural knowledge visible, for students to observe.

Summary

Research question 1 sought to identify the physical, structural, and pedagogical affordances of the studio learning environment in Architectural Design 1. The physical affordances of the open layout of the studio space, combined with the public nature of the desks/workspaces as a space for students to personally exhibit their work in progress, afforded frequent feedback and conversations surrounding the design process. Students equated the "flow" of people through the studio space, and the social interactions the flow afforded, an essential part of learning in the studio and pivotal to their identity as an architecture student. Dedicated desk space afforded students the opportunity of uninterrupted

production, space to reflect on how their work changes over time, and a sense of belonging to the architecture department. Working in proximity to other students and studios afforded frequent feedback, comparing and self-assessing and monitoring learning and performance.

The structure of AD 1 afforded long blocks of unscheduled work time and the opportunity for students to self-manage their time and progress, which many felt mimicked authentic architectural practice. The horizontal alignment between AD 1 and other courses in the curriculum afforded multiple learning opportunities to build upon and apply their knowledge and allowed students to feel that what they are learning is relevant to their development as architects. The project brief afforded a lens through which to 'see' the problem and visualize different design solutions, as well as a guide to evaluate solutions to determine their value; project constraints acted as a catalyst for ideas. The sequencing of the three projects in AD 1 afforded cyclical learning and sequencing of the tasks and deadlines within the projects allowed students to experience the design process in stages, and emphasized productivity, rapid iteration and decision-making.

The pedagogical affordances of AD 1 included formal and informal critique interactions. Desk crits and pin-ups afforded the transmission of tacit design knowledge through reciprocal showing and telling and allowed for reflection, iteration, and exploration. Pin-ups held the added affordance of public coaching, demonstrating, and modeling for students to learn the practice of critique dialogue. Formal critiques focused on presentation and external communication. Interim and final reviews afforded a space for practicing the dialogue of architectural practice. The interim review also afforded formal-formative feedback. The final review afforded the performance of "selling" their design to external audiences, while peer-led final reviews afforded direct and judgmental feedback, and

encouraged metacognition and reflection on process. Mini-lectures and demonstrations were also pedagogical affordances. Demonstrations in particular allowed for the modeling of design thinking, making procedural knowledge visible.

Studio Culture and Affordances of AD 1

Research Question 2: In what ways do characteristics of studio culture intersect with the affordances of Architectural Design 1 in how students make meaning of their architectural learning and development as architectural professionals?

Four characteristics of studio culture as defined by the literature—(a) a community of learners and architects; (b) centralizing feedback; (c) untimetabled design activity; and (d) experimentation and risk-taking—intersected with the physical, structural, and physical affordances of the studio that were identified in RQ1. In turn, students equated studio learning with learning among friends and colleagues, felt learning in the studio was more authentic than non-studio environments, and equated the studio space with a sense belonging to the architecture department. Students also felt that listening to and accepting feedback was necessary to learning and being a successful designer and that time to generate ideas and reflect on their designs in iterative cycles of process helped them learn. Students in AD 1 also felt that devoting time to working in studio demonstrates a dedication to architecture, and that individuality and uniqueness were traits of a successful architecture student. The thematic findings for RQ 2 are summarized in Table 4.

Community

Physical, structural, and pedagogical affordances of the studio leveraged to a feeling of community and belonging for the students in AD 1**.** The AD 1 studio had a casual and social student culture; peers frequently shared skills, materials, ideas, and feedback with each

Table 4. Summary of thematic findings for Research Question 2

Characteristic of studio culture	Physical affordances	Structural affordances	Pedagogical affordances
Community of learners and architects	Open space afforded frequent peer interaction; seeing work in progress was entrée for discussion	Course alignment afforded cohort model	Frequent instructor-student interaction in the form of desk crits afforded interactions which felt authentic to architecture practice
Centralizing feedback	Co-location and proximity afforded frequent informal peer feedback	Long hours to manage in "breaks" afforded informal peer feedback	Pin-ups afforded modeling and coaching in effective critique dialogue; listening in afforded a vicarious learning experience
Untimetabled design activity	Dedicated desks afforded a "home base" for uninterrupted design activity; personal exhibition space to reflect on changes over time	Long hours afforded students learning how to time manage and experience their own pace of the design process; quick pace of projects afforded rapid iteration	Frequent desk crits with expectation of "new work" afforded emphasis on process work
Experimentation and risk-taking	Dedicated desks afforded space to "play with design ideas"; open space and co-location extended space for collaboration	"Pushing" against constraints in the project brief afforded rapid ideation and a benchmarking mechanism for judging solutions	Critiques transmitted understandings of making bold statements and challenging convention in design

other in frequent, casual dialogue during work time. The physical affordances of the open studio layout enabled a flow of people through the space and encouraged social interaction among students and instructors. Students' dedicated workspaces afforded students to display their work-in-progress, which provided a context for peer conversations. Students' working in proximity with each other for long periods also contributed to a feeling of community. Students reported feeling a sense of community in the studio as early as the second week of the semester.

Casual, social student culture

In the design studio, learning activities are predominantly led by the students themselves through individualized work. The learning culture of the studio allows students freedom to express and exchange ideas while socializing (Samsuddin, 2008). Similarly, the studio space of AD 1 had a casual and social student atmosphere. Students were able to come and go from the studio as they pleased during their work time, and the constant flow of people and activity through the studio space led to frequent socializing and discussions among peers. Natalie's years of teaching studio courses in architecture has taught her the importance of teaching students how to capitalize on the social nature of the studio environment to aid their learning. For example, Natalie explained the learning culture of the architecture studio in our first interview:

> *Of course, there is kind of an overarching culture [of studio learning], which is this open, free-flowing [culture]; you can visit anybody, we're encouraging [students] to visit reviews … [students] need to go to the next person and ask them what they're doing …* (Natalie, 6 October)

When I asked students to describe the environment of AD 1, "social", "casual", and "relaxed" were the most common descriptions. Students felt that the studio was a very social and relaxed learning environment which allowed them to work at their own pace and socialize with their peers. *"[Studio is] super chill,"* Kendra said, *"Even though [students] are like doing their studio and stuff, we still talk with one another, joke around, while doing our stuff."* For example, Raven reflected on how studio felt compared to other non-studio classes:

> *Yeah, I felt like [AD 1] was a chill, more informal class where you just meet [with the instructor] one on one, and then everyone else has their own time and they can really use it however they want. [Natalie] was really honest about always working. She was like "You really need a break sometimes."*

> *People watched TV while they worked. She doesn't really care, as long as ... She's going to judge you on your product.* (Raven, 9 December)

Students also described the AD 1 studio as a fun and enjoyable place to learn. Jon remarked that studio was *"...way more fun than physics (his previous major)"* because architecture was a very social learning environment. *"Working, hanging out, goofing around, and making jokes, making friends. It's like a huge awesome environment to do things and meet people,"* he said. This social, informal culture resulted in a fun, enjoyable place to learn, which in turn, motivated students to come to the studio to work and learn together. Jon added:

> *It's social but it's also very functional. I don't know. I feel like working with someone is a lot better than working without ... I'm totally able to sit here, work and talk to people. It's fun to be here. I love being here. It makes me want to come back in the next day which I think is really important because if I don't come back in the next day then I'm not going to progress.* (Jon, 4 September)

Helping and sharing. I often observed peers often helping each other in AD 1. For example, Jon often lent his model making skills to his classmates, Kendra and Tim shared materials and supplies with each other, Brady tutored John on how to use certain features of Photoshop, and third- and fourth-year architecture students gave AD 1 students advice on how to layout their boards for presentations. Students supported each other through sharing ideas, tools, and approaches; students also supported their peers with homework for other courses which encouraged and motivated students to stay engaged in their learning. Allison noted:

> *I feel like I am learning a lot and it's awesome to have people to always talk about the stuff that I'm learning [about]. We study for tests and stuff together. We'll stay after and all study. That's the good thing about being there all the time, that sometimes I might not feel like getting something done, and then they'll kind of push me. Jon pushed me to study a little bit longer for this test. I*

> *wanted to go earlier than he did, and then I stayed. I think I did way better than I would have done, otherwise. Little stuff like that is good, just [to] encourage each other.* (Allison, 18 November)

Students also stated they felt comfortable sharing their ideas with their peers in studio because they were surrounded by "friends". Brady said:

> *I have a really good close group of friends now in the design studio. I mean as whole we're closer and we're more open with each other. I mean people won't admit it, but automatically [you] become closer and you're more open about your ideas.* (Brady, 23 October)

Students spoke of their peers in the AD 1 studio as "friends" and used the term "community" and "family" in describing the studio as early as the second week of the AD 1 course. Brady noted:

> *I felt it since the second day. Yeah. Felt really close. I don't know [why], it was weird. Everyone was just friendly; everyone was talking to each other. I mean it's not like, nowhere to my fraternity, or my good friends outside of the design school, but I do feel like we are a family, in a sense. And I feel like we all kind of care about each other, we have each other's backs, and that sort of thing.* (Brady, 9 September)

Toward the end of the course, students expressed regret that they would not be in studio with the same peers next semester. In our last interview Peter reflected, *"We all went out to dinner [when studio ended] and I was actually sad; I'm not going to see these guys, it's weird."* However, students also acknowledged the opportunity to form new relationships with others in a new studio environment by reflecting on how relationships with their peers in studio afforded for their learning. Many looked forward to the influences these new relationships would have on their work. *"I'm kind of sad, because I love our studio, but it'll be cool to see how my work evolves just from being around other people",* Allison stated. Students felt strongly that the community of the studio and learning with their peers were the best aspects of AD 1. Brady said:

> *I think it's the fact that our lives, our future, we're building it with them, you know what I mean. This is like a huge step. There's this, and then there's adulthood, I mean, in our eyes. Some of these people are the people I'm going to be potentially working with some day. These are the people I will be calling up, being like, 'How's life going? How's it been?' I would do a lot, if I could keep this group of people through my entire life, even if we all started an [architecture] firm I'd be like, 'Let's go!'* (Brady, 23 October)

Intersection with affordances

Various physical, structural, and pedagogical affordances of the studio helped contribute to a feeling of community and belonging for the students in AD 1**.** The physical affordances of the open layout, dedicated desk space, and proximity of students working in the same physical space, the structural affordances of alignment of the curriculum and shared projects, and the pedagogical affordances of desk crits leveraged a feeling of community.

Physical. The physical affordances of the studio space, the open layout, dedicated desk space, and working in proximity to others, allowed for a flow of people and informal conversations and collaborations in the AD 1 studio. For many students, these casual collaborations also helped build community among the students in the studios; students felt it was easy to make connections with their peers because the space was so open. Students had personal, dedicated work spaces that allowed for private work and public work or exhibition space, and the public/private work spaces allowed for students to make their work visible to others and encouraged frequent informal feedback and idea exchange with peers. Brady said:

> *For me, just being in different environments, for example, if you go to the library, it's a very different feel than design school. We're a lot more talkative here. We're a lot more social; we're somewhere where ideas are being exchanged.* (Brady, 23 October)

Displaying students' work in progress at their desk spaces was also seen as an entrée to starting conversations with peers, which both helped the ideation process and establishing relationships with peers. Kendra noted:

> *It's easy for us to get some ideas from other student by just going to their desk and say "Hey, how's it going" and "How's your project?" I'm pretty sure they're just going to start talking about their project and it's going to give you a lot of ideas.* (Kendra, 2 September)

Structural. Students in AD 1 were concurrently enrolled in a design communications course, a building science and technology course, and an architectural history course as well as AD 1. Not only was the content across these courses aligned, especially in the beginning of AD 1, but also all students in AD 1 took the same courses together as a cohort, and used the AD 1 studio as a workspace for their work in these other courses. Therefore, the physical affordances of the studio also intersected with the structural affordances; students worked together as a group in the same space, every day, all day all semester and they took the other courses in the first-year curriculum together as a group. Peter described the curricular alignment and learning as a cohort *"…like elementary school"* were students take all the same classes as a group. "*It's weird to connect to something like that,"* he said. Students felt the cohort model combined with the physical affordances of dedicated space and proximity helped this peers form close relationships with each other in AD 1. Allison added:

> *The design kids just bond really hard, because we're all together in these same classes all the time. It makes me feel like I have friends and people that I can always refer to if I miss a class or if I want a critique in the middle of the night and we're there, or whatever. There's just always people to help you, which is nice.* (Allison, 2 September)

Pedagogical. The pedagogical affordances of desk crits also leveraged a feeling of community within the studio. Desk crits afforded regular one-on-one interactions and guidance from Natalie. Over the course of the semester students established close relationships with Natalie due to their daily interactions, and the formality between Natalie and her students lessened over time. Students frequently joked and casually chatted with Natalie during studio; she was described as "cool" and "chill", and students felt she was informal and approachable. Natalie frequently sat at the table in the center of studio and students would approach her for feedback and questions, and sat down with them at their desks to interact during desk crits. Students felt that frequent one-on-one interactions between students and instructors led to an informal culture of learning in studio. All the students preferred the informal learning atmosphere of the studio and learning in the studio felt more "real" than other non-studio learning environments. Raven stated:

> *I think [studio is] less formal, and the professor is more approachable, because she's in the center, sits at the same level as you. She's not up at the front, lecturing. I think a lot of things about design are a lot more casual than other majors. I just feel like, I don't know, it's more real, because, I don't know, just the whole thing we can call our professors by their first names. Other majors, no. My brother's an engineering major. It's very formal. I think it's more organic here, just get to interact with other humans.* (Raven, 9 October)

Summary. Physical, structural, and pedagogical affordances of the studio leveraged to a feeling of community and belonging for the students in AD 1**.** The studio space of AD 1 had a casual and social student atmosphere. Students described the environment of AD 1, "social", "casual", "relaxed", and "a fun place to learn" and supported each other through sharing ideas, tools, and approaches which encouraged and motivated students to stay engaged in their learning. Students spoke of feeling a sense of community and belonging in

the studio as early as the second week of the course. The physical affordances of an open layout and proximity to others allowed for frequent social interaction, resulting in close relationships between peers. Alignment between the courses and a cohort learning model also contributed to a feeling of community. Daily desk crits afforded for regular one-on-one interaction between Natalie and her students, resulting in an informal learning atmosphere in AD 1 which felt more authentic to students than other non-studio learning environments.

Centralizing feedback

The nature of dialogue in the architecture studio centers around feedback through one-on-one communication between the students and their instructors and peer-to-peer interactions (Dannels et al, 2011). Feedback was so central to the AD 1 studio environment that accepting and analyzing feedback was seen as critical to learning and success as an architecture student. Physical affordances of the AD 1 studio, such as the open layout and working in helped facilitate feedback among peers. Long hours in the studio afforded students' management of their work and time where students used their breaks away from focused work to interact and offer feedback to others. Critiques in all their forms were the pedagogical vehicle for feedback in AD 1; desk crits in particular afforded feedback through one-on-one dialogue, while students' listening in on other's critiques afforded learning how others' approaches would help them be successful with their own tasks.

Sources. There were various sources of feedback in the AD 1 environment, with the main sources being one-on-one instructor feedback, feedback from peers, and feedback from other instructors and visiting critics. Each of these will be described in the sections that follow.

One-on-one instructor feedback. Students working in the AD 1 studio developed individual approaches to solving the problems posed in the project briefs, so Natalie provided one-on-one guidance to each student, helping them progress through the design through individual feedback. Natalie's one-on-one feedback discussions with students included mostly investigative questioning to make sense of what she saw in students work, followed by process-oriented feedback focused on the students' design approach or process and providing observations or insights on their process. She also used direct recommendation feedback, offering advice about how to proceed with the design.

> Natalie and Jon are doing rapid Q&A. Jon explains his design while referencing drawings in his sketchbook mostly. Natalie is constantly questioning his decisions and comments on how he is explaining his ideas (his presentation) simultaneously. (Field note, 2 November)

Natalie and her students engaged in a similar feedback dialogue at least once each class session at a desk crit. She also provided feedback and whenever students approached her for help when they were stuck with a design problem.

Peer feedback. Often, students had more contact with their peers than they did their instructors in AD 1 and exchanged ideas freely with their peers on a regular basis, sharing ideas and solutions and gaining feedback. Much of the feedback in peer dialogue was brainstorming the possibilities for changes to their peers' design, or feedback where students will suggest looking at an architectural precedent, reference another students' approach to the same problem, to help their peer become "unstuck". Raven said:

> *I like to talk to other people and get their feedback. I get really great ideas from my classmates and just stuff that I wouldn't have thought of. They're like, 'You should do this.' It really works out! Talking to other people, collaborating and then getting feedback from the instructor definitely really helps me.* (Raven, 2 September)

Natalie felt that her AD 1 students gave each other a lot of feedback because they had formed close relationships with each other quickly in the semester and equated this with the open, social nature of the studio environment. She noted:

> *They're not afraid to say something about someone's work. They're not afraid to say something about their own work, which I think is good because a lot of times, you find people critiquing other people's work and not their own and not wanting feedback from anybody….It's because of that openness of the studio and the culture of the studio that has formed.* (Natalie, 6 October)

Feedback from other instructors or visiting critics. Students also gained feedback from other AD 1 studio instructors, other architecture faculty, and at time, professional architects who were invited to studio. These feedback dialogues had a different typology than the one-on-one guidance form Natalie and peer feedback. Feedback from other instructors and critics was predominantly judgmental, assessing the quality of the work. Visiting critics also offered direct recommendations about how the design should be "fixed" or improved. The dialogue in these reviews was dominated by the instructors and had a tendency to be highly critical of students' work. Faculty were very direct with their questioning, pointing out the shortcomings in students' work which could place students in a position of defensiveness.

> "Don't do with graphics what you should do with space." Instructor A is drawing on the window with a dry erase marker, using the window as a sketchpad. He asks Brady about the 'gate' theme to his design, "What is 'gate' about?" Brady shows him what is 'gate' about his design. Instructor A then says "it's gate-like, but there's no gate. What you're telling me and what you're showing me are two different things." He then asks Brady about the façade of the building, says "its weak". "Do you blend in or stand out? Do you know Rem Koolhaus?" Brady says no. "You should by now. What does he say about context?" Instructor A then writes FUCK CONTEXT on the window. "What does the program want? What does the concept want? What does the client want? That's what the design should be." (Field note, 9 November)

Students commonly perceived the feedback from other instructors and visiting critics as “harsh”; they commented that faculty could “rip apart” students in reviews, that students “get grilled”, instructors “bash” them and can “be aggressive”. Students also equated a harsh feedback with being “direct” and “brutally honest” about what is successful in their design and what isn’t working. Raven said:

> *Okay, so Instructor A is very brutally honest, which I really ... I am pretty honest, too, so I find that that's effective for me. Sometimes it comes off as a little bit aggressive, and then people are, "Oh my God." For me personally, I know that he wants you to succeed, so he's not just saying things to be mean to you. The dialogue? Yeah, he's very straightforward, so it's not ... I mean I think that's more effective. Because then I actually know what I should focus on, what's not going well, what's going well, and so it's very clear.* (Raven, 11 November)

Accepting and analyzing feedback. Offering and receiving feedback was a central activity in the AD 1 learning environment. As a result, both Natalie and her students felt that listening to and accepting feedback was necessary to learning and being a successful designer. As Jon noted, *“If you want your design to be successful, you have to listen.”* Students insisted that accepting feedback was what helped them learn. Peter said:

> *You got to be able to respond to critiques. You've got to be able to change your idea and that's a big thing. Like if you just fall in love with an initial idea you're kind of shooting yourself in the foot. [You need to] allow yourself to change it to grow, to refine.* (Peter, 11 December)

Students also felt that listening to their peers’ feedback in particular was key to being successful in studio. Brady mentioned:

> *When I get criticism [from peers] it starts to refine what my idea of what my own project is. Other people's opinions are very, very important to my thinking to how I develop things…. I've become a lot more open minded. I'd go, "Well, everyone has their reasons for why they do something." I think that connects back to design. I have a reason why I design this way, that way [but]*

> *t's good to take outside opinions. You become a better individual.* (Brady, 23 October)

For many students, learning how to critically assess the feedback they received was also an outcome of the AD 1 studio course. Natalie encouraged frequent informal feedback between her students in AD 1, and since feedback was so plentiful, one of Natalie's learning goals was for students to discern when feedback was useful and when it wasn't. Natalie reflected on this tacit outcome of the studio in our first interview:

> *What my dad used to say is, "When you eat fish, you spit out the bones." So you chew the flesh, or you eat the good stuff and spit out the bad. You have to understand what [feedback] is working for your design and not, because everyone has their own idea and you have to hone your method and you have to be confident about your method and be able to explain it.* (Natalie, 6 October)

Students acknowledged that accepting all feedback isn't productive to their progress, and ultimately, they must decide what feedback is useful. John said:

> *I definitely learned how to analyze [feedback], and I realized that critiques aren't always good. Sometimes when you don't have what you want, don't get critique on [your design] until you figure out what [feedback] you want. So, I need to learn how to do that.* (John, 15 December)

Intersection with affordances. Physical affordances of the AD 1 studio, such as the open layout and working in proximity helped facilitate feedback among peers. Long hours in the studio afforded students' management of their work and time where students used their breaks away from focused work to interact and offer feedback to others. Critiques in all their forms were the pedagogical vehicle for feedback in AD 1; desk crits in particular afforded feedback through one-on-one dialogue, while students' listening in on other's critiques afforded learning how others' approaches would help them be successful with their own tasks.

Physical. As noted previously, the physical affordances of the studio allowed for regular peer interaction and feedback. The open layout of the studio allowed students to easily access other students' dedicated work spaces, where they observed their peers' designs and engaged in dialogue and offered feedback about work in progress. Chris said:

> *I like the fact that other people can see my work and just students can talk about what they like about the work. Some other advice that if I'm having a problem struggling with, I can ask and they'll give me some sort of feedback.* (Chris, 11 November)

Students' proximity to other studios also enabled them to engage in feedback dialogue with *students outside their own studio. Kendra said:*

> *[Proximity to other studios] helps my learning because we're gathered with other architecture students, so it's easy for us to get some ideas from other students by just going to their desk and saying "Hey, how's it going" and "How's your project?" I'm pretty sure they're just going to start talking about their project and it's going to give you a lot of ideas.* (Kendra, 2 September).

Proximity also enabled students to gain feedback from other AD 1 instructors and allowed students to hear how different instructors provided feedback to other students so they were exposed to different opinions and styles of feedback. Peter shared:

> *I listen to Kendra's and Tim's [critique] probably because, one, their stuff looked good and I was interested in it, but also because Instructor A was reviewing it and I don't know. I really like Instructor A. I think he knows what he's talking about… I like the feedback that he gives. I think he's, in my opinion, Instructor A's a little less out there when it comes to the design. I don't know…I feel like Instructor A's a little more practical when it comes to [advice] which I appreciate.* (Peter, 13 November)

Structural. Long hours of studio time also encouraged feedback among peers. I observed that when students needed to take a break from focused design work, they would use their break time to visit other students' desks and engage in conversation and give feedback. Students also personally managed their working time around their scheduled one-on-one time critique time with Natalie. However, toward the end of the term, students felt

that their work time became interrupted by their critiques with Natalie. For instance, I observed that toward the end of AD 1 a few students opted to stop having daily one-on-one critique sessions with Natalie. Tim said:

> *I'm getting less feedback in class because of the way I'm choosing to work. That's partially because of like I prefer to use the time we work and I feel like when we do desk critiques we spend a lot of time just sitting around, because like they're waiting to be critiqued. I choose to use the time to work instead….That's working so far I think. Like I was saying before, I'm more productive because I'm not sitting around waiting to be critiqued and stuff like that.* (Tim, 11 November)

Students also demonstrated an awareness of how their feedback interactions with Natalie affected their productivity. For example, Jon reflected on how his one-on-one feedback sessions with Natalie was balanced with his personal work time and productivity.

> *It's not necessarily the amount of time that it takes me to change it, it's just the amount of feedback, and it'll take me one feedback cycle to do a certain number of changes. That doesn't give me a lot of time personally. If I could talk to Natalie every five hours and kind of talk to her 20 minutes for every five hours, I could have gotten to this design within a matter of a day or two. I would have liked that. That's how I would change it.* (Jon, 8 December)

Pedagogical. As stated previously, critiques were the central pedagogical feature of AD 1. Since critiques were the learning activities in which feedback dialogue took place, they naturally center feedback as a main cultural element of the studio environment. Desk crits facilitated one-on-one feedback with Natalie, through which direct teaching and guidance took place. Pin ups afforded the modeling of effective critique feedback by the instructor and gave students a chance to rehearse the language of effective feedback. Final reviews offered judgmental feedback on the final design product; the feedback climate could be harsh and confrontational but students perceived direct feedback in final reviews as "honest" and "direct". Listening in on others desk crits, pin ups and reviews allowed students

a vicarious learning experience; through witnessing the critique and taking part in a discussion about others' performance, students learn what actions and interactions would help them be successful with their own tasks.

Summary. Social interaction in the studio centers around feedback through one-on-one communication between the students and their instructors, peer-to-peer interactions, and interactions with visiting critics. Accepting and analyzing feedback was seen as critical to learning and success as an architecture student. The open layout and students working in proximity helped facilitate feedback among peers. Long hours in the studio afforded breaks away from focused work where students would interact and offer feedback to others. Critiques in all their forms were the pedagogical vehicle for feedback in AD 1. Desk crits facilitated instructor-student feedback, while pin-ups afforded the modeling of effective critique feedback. Final reviews offered students direct, judgmental feedback. Students' listening in on peers' feedback from instructors afforded learning how others' wrestle with problems and create solutions which would help them be successful with their own tasks.

Untimetabled design activity

The main use of the studio in many design disciplines is in large blocks of unstructured time (Lawson & Dorst, 2009). There are both scheduled and unscheduled events in studio. These may be scheduled lectures, critiques, and meetings, or visits away from the physical space of the studio such as site visits or field trips. Many learning activities in the studio environment, however, are scheduled when it is needed. Much of the studio course is left open and unscheduled for students' design activity. Lawson and Dorst stated that design is an activity that is difficult to place on a time schedule; it is unknown how

long each phase of designing will take. As a result, different students will require varying lengths of time for each phase of a project. Thus, a cultural aspect of studio learning is dedication of time and space for untimetabled design activity.

Students in AD 1 engaged in individual design activity for long hours at a stretch, both during studio time and on the evenings and weekends. As a result, students experienced a blurred boundary between "studio" and "non-studio" time, making little distinction between scheduled "class" time and their personal work time. Natalie emphasized process and production in her teaching and grading, and students felt strongly that time to generate and reflect on their designs in iterative cycles of process helped them learn. Students in AD 1 also equated time with dedication to architecture, acknowledging that being a successful architecture student means being present in studio to work on and refine their designs.

The physical affordances of dedicated desk space and working in proximity supported students untimetabled design activity. Dedicated desk space afforded students the opportunity of uninterrupted production and "pin up" space to reflect on how their work changes over time. Students' working in proximity eliminated the isolation of working for long hours. Structural affordances of long hours devoted to studio afforded the ability for students to work at their own pace and provided opportunities for them to learn how to self-manage their time and monitor their own progress; the quick pace of the projects and their deadlines afforded rapid iteration and decision-making, and allowed projects to move forward through repeated iterative cycles and incremental growth. Pedaogical affordances of regular desk crits supported iteration and change, and development of ideas over time.

Long hours in studio

The majority of the time in the AD 1 studio course was spent with students working individually at their desks. However, the AD 1 syllabus also stated the expectation that much of the students' work should be done outside of class time, even though students had twelve hours of scheduled class time per week. Although the AD 1 studio course was held from 1:00 – 5:00 pm on Mondays, Wednesdays, and Fridays, many students were in the studio from approximately 9:00 am until 5:30 pm, depending on what work they had to do that day. Raven said:

> *I think of it as, I basically have a full day, it's 9:00 to 5:00, and so I'm just going to come here because I'm already awake, I'm just going to go work on my stuff and then work on it more when Natalie shows up.* (Raven, 9 October)

Others arrived closer to 1:00 pm when studio started, took a break after studio class to have dinner, then returned to work in the evening. Peter mentioned:

> *Usually, especially when I have a lot to do, after studio I'll still stick around until I reach a good stopping point, so maybe that's a couple hours after studio, maybe longer. Then I'll go home, get some dinner, kind of relax for a couple of hours and then come back here and work a little more….towards the end of studio, if I'm in this mindset where I'm being really productive, I continue that until I'm just pooped. I need a break.* (Peter, 14 October)

Students began to spend long hours in the studio as early as the second or third week of the semester. During the second week of AD 1, Chris commented that the studio was already *"…like [my] second home."* He added:

> *I'd say because we're in here a lot more often [than home]. Even a lot more often outside of class. Obviously, I'm here after most of my classes from the day, from 10 or 9 to whenever I'm done with classes. I don't usually go home except for sometimes if I want to get lunch at home.* (Chris, 4 September)

Blurred boundaries of time. I also noticed very early in the course that students made little distinction between class time and personal work time, or experienced a blurred

boundary of class and personal time. For some, the only difference between class time and "non-class" or personal time working in the studio was the presence of Natalie. Peter said:

> *Yeah, that's kind of weird. Yeah, because a lot of times if I'm in studio like the one to five time slot, I do the exact same thing that I would if I were here any other time. The only distinction would be whether or not Natalie is here and whether or not I have the potential to get like a desk crit in or something like that. Yeah, that's pretty much the only difference [between in-class and out of class]*. (Peter, 13 November)

Time to develop ideas

Natalie emphasized students' process and near constant production of work in her teaching and grading in AD 1, and students felt strongly that devoting time to reflecting on the iterative process of designing helped them learn. Natalie explained her emphasis on process over product in our last interview:

> *[In] my teaching I am more of a process person and I have them produce their process until the end. They will have final work but I have them not view their final as a final…When I say, 'process' I mean, how do you think through a design? How do you get from one point to another? How do your ideas begin to unfold into an actual design?* (Natalie, 18 December)

Thus, Natalie repeatedly told her students she expected them to document their process as they progressed, to reflect on these changes and learn from them. Tim said:

> *She's having us spend more time developing our idea and doing iterations of our ideas. That way we have a deeper understanding of our own project. I like that a lot, actually, because like what we were talking about before, how I have a tendency to just pick one idea and stick with it. I like being forced to have to think about the idea deeper and develop multiple ideas.* (Tim, 7 October)

Students felt that having a lot of iterations to their designs helps them feel more secure about the final product; and devoting time to developing iterations of their designs was key to being successful in architecture school. Raven exclaimed:

> *[Being successful takes] a lot of iterations and time. Just a lot of changing your idea, because you think you have this awesome idea, and you can either take that right then and then go with it, or you can keep thinking about it, keep drawing it in different ways, and then sometimes you're ... Basically your first idea is never your best idea. Usually it's not. ...I just feel more secure about my ideas when I do multiple iterations. Because I'm like, "This is the best choice." Then I can really get into it and support it.* (Raven, 11 November)

However, the emphasis on iteration and long hours devoted to work could also lead students to feel like they were never done with their projects.

> *When you're in [other classes] you know when you're done, you know when you're done with a project, and [in AD 1], you have to iterate and do all these iterations. You could be done, you could not be done. There's never a point you know. I don't know, sometimes I have this idea, it's my first idea, and that's never your best idea, but sometimes I'm like, "This is such a good idea," and then, "No, I have to have more process work," so I then end up having to redo it. The end result is usually better anyway because I think about more things, more components, like how people will interact more and stuff. But I don't know, it's annoying sometimes, because I just want to be done with my [AD 1] work.* (Raven, 9 October)

Time = dedication. Students also felt that being present in studio and constantly working and refining was equated to being committed and dedicated to architecture practice. Allison said:

> *I think you probably work long hours [as an architect], and you just have to be on your game, all the time, thinking of ideas and stuff. I think, yes, just hard work, is the number one thing that you have to do. You can't be lazy. A lazy architect is, just, like, not a thing.* (Allison, 18 November)

When I asked students at the end of AD: What it takes to be successful as an architecture? student, time, dedication, and effort were the most common answers. *"You've got to put the effort in,"* Chris said. Spending long hours and personal time in the studio environment, or "putting the time in" to studio, was seen as a quality of a successful architect student. *"The people that didn't work [hard] in studio were the ones that I didn't think had successful*

designs." Jon reflected, *"…work ethic is very important."* Allison stated, "*You have to be prepared to do so much work, all the time; I think it just takes a lot of will[power]."* Jon concluded:

> *If you work hard, if you design something good, you have to work hard and get better. If you're good at design, you have to work hard ...You have to get [ideas] on the paper. You have to motivate yourself, you have to work hard and motivate yourself. You have to work hard to do your best work on the paper. I don't know. [Architecture] requires time and commitment, and effort.* (Jon, 19 November)

The perception of spending long hours of personal time in studio as being dedicated to architecture also had negative effects. Some students reported feeling pressured to be present in studio even if they completed many of their daily tasks during class time. Peter mentioned:

> *[It] sucks on the weekends, because I don't want to be here on the weekends, but I have stuff to do. I don't see a point in being here if I don't have to be here. But I feel like some people would think, "Look at him, he's hardly ever here," even if I'm not working on something.* (Peter, 14 October)

Some students also felt their peers would judge or label them as not being committed to their architectural studies if they weren't present in studio outside of class time most evening and weekends. Brady said:

> *I mean, the things [my peers] say. It's not like they ... They'll make smart comments and that kind of thing. That's where a lot of the ... You're trying to catch up, and you're, "Oh, look, why aren't you [in studio]?" You get a little labeled, as "Well, you're a non-studio person, you're a non-architect person. You're not involved in the studio as much, so who are you?" kind of thing. I guess that's kind of sad, the fact that you have to be in the studio to be credible, and if you couldn't be there that's ... [not] everyone works well in the studios, and that's how it is.* (Brady, 14 December)

Intersection with affordances

The physical affordances of dedicated desk space and working in proximity supported untimetabled design activity through allowing for interrupted production and providing a space for reflecting on changes in the design evolution. Working in co-location and proximity with others eliminated the isolation of individual work. Structural affordances of the studio, such as long hours devoted to studio in the curriculum, and the project pacing and sequencing of tasks enabled students to self-manage their time and monitor their own progress, and allowed for projects to move forward through repeated iterative cycles and incremental growth. Pedagogical affordances of desk crits helped students progress their design ideas.

Physical. The physical affordances of dedicated desk space and working in proximity supported students untimetabled design activity. Dedicated desk space afforded students the opportunity of uninterrupted production and "pin up" space to reflect on how their work changes over time. Students' working in proximity eliminated the isolation of working for long hours.

> *...we all have our own little cubby (desk space), and I like how we have our own little cubbies, it makes it feel like a home away from home. At least for me it is, because I live far away from campus, so the travel, you know, I have to bring a bunch of stuff here, and I'm here the whole day, and so throughout my whole day I just come back here even if I have classes in other buildings, I always have this place to come back to. And to me it's kind of like a think tank, you come back here and you have all these brains thinking, and I have neighbors right next to me and you just turn around and be "hey, what are you doing?" I like that feel.* (Brady, 9 September)

Twenty-four-hour access to the AD 1 studio, although not necessarily an affordance of the studio environment itself, also supported working in studio outside of studio "class" time.

Structural. Various structural affordances also intersected with a culture of untimetabled design activity. As mentioned previously, the long hours devoted to studio in the curriculum mostly devoted to students' individual work time afforded the ability for students to work at their own pace and provided opportunities for them to learn how to self-manage their time and monitor their own progress.

The project pace and sequencing of tasks also intersected with untimetabled design activity through emphasizing iteration and process. The quick pace of the projects and their deadlines afforded rapid iteration and decision-making, and allowed projects to move forward through repeated iterative cycles and incremental growth. Students mentioned the quick pace of the deadlines in Project 1 and 2 taught them how to "think fast", in order to "pump out ideas" and "keep working and keep designing", and "keep producing". Students also recognized the smaller, incremental deadlines within the projects pushed them to "have a product" at each stage, breaking the project up into smaller pieces in order to get everything done by the final deadline.

Pedagogical. Daily desk crits supported time devoted to iterative design activity. Although the majority of time in the studio was dedicated to students' individual work time, Natalie conducted daily desk crits with each of her students in AD 1. The desk crit was Natalie's way of checking on the progress of each student, advising students on how to manage their time, addressing any problems or issues with the design, and generally guiding and coaching each individual student. Natalie also expected students to have new work to show her at each desk crit, thus besides affording feedback, the desk crit also helped students progress their design ideas. Peter said:

> *Natalie definitely puts an emphasis on process work and getting things done on time, showing multiple iterations, being able to talk about yourself and just having tangible things ready to talk about [at each desk crit], which I definitely understand, need to have those things done. [Desk crits help you] to be creative, be able to think outside the box for a lot of things.* (Peter, 13 November).

Summary

The main use of the studio in many design disciplines is in large blocks of unstructured time (Lawson & Dorst, 2009). Students in AD 1 engaged in individual design activity for long hours at a stretch, both during studio time and on the evenings and weekends. Students in AD 1 experienced a blurred boundary between "studio" and "non-studio" time, making little distinction between scheduled "class" time and their personal work time, demonstrating a culture of using time that is distinctive to studio learning (Lawson & Dorst). Natalie emphasized process and production in her teaching and grading, and students felt strongly that time to generate and reflect on their designs in iterative cycles of process helped them learn. Students in AD 1 also equated time with dedication to architecture, acknowledging that being a successful architecture student means being present in studio to work on and refine their designs.

The physical affordances of dedicated desk space with 24-hour building access, and working together in proximity supported students' untimetabled design activity. Dedicated desk space afforded students the opportunity of uninterrupted production and "pin up" space to reflect on how their work changes over time. Students' working in proximity eliminated the isolation of working for long hours. Structural affordances of long hours devoted to studio afforded the ability for students to work at their own pace and provided opportunities for them to learn how to self-manage their time and monitor their own progress; the quick

pace of the projects and their deadlines afforded rapid iteration and decision-making, and allowed projects to move forward through repeated iterative cycles and incremental growth. Pedaogical affordances of regular desk crits supported iteration and change, and development of ideas over time.

Experimentation and risk-taking

Schön (1983) described design learning as reflective knowing-in-action, as designers engage in a "conversation with the materials of a design situation" (p. 175). Students of architecture engage in inquiry learning though making representations of built structures. Thus these representations are central inputs to the thought process, and executing and managing them are the central skills of designing (Larson & Dorst, 2009). In AD 1, experimentation with various forms of representation, in drawings, diagrams, and models, enabled students' design ideas to change and evolve. Students equated working by hand with being able to experiment and take more risks with their design ideas. AD 1 students spoke frequently that encouragement to take risks and to try new things also helped them learn. However, a culture of experimentation and risk-taking could be at odds with a culture of education based on grading and assessment. The culture of experimentation and risk taking in AD 1 was also equated with individuality and uniqueness, which were perceived by students as the most valuable traits of a successful architecture student.

The physical, structural, and pedagogical affordances of the AD 1 studio environment supported a culture of experimentation and risk-taking in a variety of ways. Dedicated desk spaces allowed for students to have a "home base" for uninterrupted design activity, while the open layout and working in proximity afforded extended space for experimentation and

collaborations. The structural affordances of AD 1, namely the project briefs, allowed students to push against the constraints which served as a catalyst for their creativity. The pedagogical affordances of the critiques transmitted understandings that experimentation and risk-taking were important to the creative process, and that making bold statements and challenging convention were traits of a successful architect.

Experimenting with representations

In AD 1, Natalie encouraged her students to learn through experimenting with different modes of representation. In particular, Natalie emphasized hand drawing and building models as allowing for reflection on learning during the design process. She explained that developing students' "…hand to eye, brain to hand" coordination was important to her because it slows down the process of designing and allows students time to reflect on each stage of the process.

> *It plays a role in how they think and how they learn and also how they're exhibiting how they're feeling what they're learning... I feel the same way with design studio, at least this level, that there needs to be an understanding of how they're thinking, why they're doing things…the opportunity to go through this process of breaking down that idea into different components. Which is what I would really love, and where I'd love the students … I don't think they're there. I'd love them to get there. Break down the components or their ideas in their head so that their design works and their design actually improves.* (Natalie, 6 October)

Students also felt that experimenting through drawing and making was an important source of ideas and understanding fundamental design concepts. For example, Tim explained how "playing" with block of foam helped him think about mass and form in the design of his building for Project 2:

> *I started by modeling instead of by drawing because I was working with this foam material. Making these perfect curves would be more difficult with*

> *drawing then it is just gluing down pieces of foam. That was my idea generation, [it] was just playing with this foam and seeing what I could do with it to make these shapes.* (Tim, 7 October)

Allison explained how making "messy sketches" allowed for her freedom to experiment with ideas in the early stages of Project 3. She said:

> *Just making ... Just experimenting a lot. I've been making more messy sketches, whereas before I [was] trying to make them really neat. Yes. I think that's probably the other thing [that's been helpful]; I just have to keep messing around with ideas.* (Allison, 18 November)

Taking risks

Conceptual risk-taking was also encouraged in AD 1. Students frequently spoke of needing to "take risks" or "push the boundaries" of their designs to be successful. For example, Tim spoke about abandoning an initial design for Project 3 because he thought it was "too safe".

> *I actually thought that last week ... I honestly was thinking about scrapping my project and doing something completely different. I thought I was playing it safe. I thought that my project was just ... It was simple. There was a lot of thought that went into it, obviously, but it was very simple. It wasn't pushing it. I wanted to really ... I didn't want to present something that's kind of bland. It wasn't bland. I'm just saying, in my mind I felt like I was playing it safe. I felt like, at least for the next few years, I don't want to play it safe in my designs. I think the only reason I had that thought was because I was watching TED Talks from deconstructionist architects, so got sort of in this mindset that I should be doing crazy things. I think that's part of it, definitely.* (Tim 8 December)

I also noticed that AD 1 instructors encouraged students to take conceptual risks because they felt architecture school allowed for the freedom to experiment, whereas the real world of architecture practice did not. Peter noted:

> *Which, I don't know. I understand that, and Natalie told me, she's like, 'You should take advantage of being able to make things unique and not having to adhere to what's around you, because in future years, you're going to wish*

> *you could go back and screw around and do whatever you want.' Which, I don't know, that ... I don't know, I listen to that because that does make sense. May as well do it while I can.* (Peter, 13 November)

External critics and reviewers frequently spoke about risk-taking when judging the effectiveness of students' designs. Reviewers were quick to point out when they felt a student was, or was not, taking enough "conceptual risks" with their designs, and equated "pushing the limits" of convention with being a successful architect.

> The first reviewer asks Peter, "Where do you feel like you took your biggest risk as a designer?" Peter responds that he's not much of a risk-taker, and that he took a risk trying to show unity with Main Street. The second reviewer responds, "Do you see the oddness of your logic? You want to unify with buildings that don't match." Reviewer 1 continues, "Push harder and question your decisions as an architect. Don't just say 'I did a project because my teacher made me do it.' This is your chance to push and explore. What do you make and why do you care about it?" (Field note, 7 December)

Trial and error. Natalie and her students also felt that having a "trial and error" mindset and embracing mistakes when taking risks was also important to learning in architecture. Natalie felt the students who were successful were not afraid to change their designs if they weren't working. *"It's not only persistence, but also not being afraid to say 'oh I'm going to change it. I'm going to work on it until it actually works,' "* Natalie said. At the end of AD 1, students also reflected on how embracing trial and error will help them be successful in architecture school. John said:

> *I feel like I need to improve on that side because like a friend of mine, a person told me that I shouldn't like, just like say 'no'. You know I should like listen to [ideas] and then try to see if they work or not. Try it out and then if you don't like it, make an informed decision and like say 'no'.* (John, 15 December)

Students also recognized having a trial and error "mindset" was an important skill for life-long learning. Raven noted:

> *I think just like the mindset, keep the mindset that you constantly learn throughout your career, too, that when you graduate you still don't know as nearly as much as someone who's been doing it forever. So, yeah, that mindset that you're always going to learn new stuff, you're not going to be right, your ideas might get shot down. You might think something's great and then you remember "Oh, we had this restriction on it." And that you're going to make mistakes, and that's okay.* (Raven, 9 December)

Negotiating between experimentation and grading

Although Natalie and her students emphasized experimentation and risk-taking as important to learning in the studio, students had to balance experimenting and risk-taking with performing for assessment and grading and instructors' expectation, which at times could lead to conflicting messages.

> [Student] asks her peer whether or not she should add certain contextual elements, like trees or landmarks, to the model. She decides not to add them with the caveat that "Natalie won't like [that I didn't add them]". The peers says "but Natalie is grading you!" [Student] replies, "I'd rather take the risk and get shit on in review than not take a risk at all." (Field note, 6 December)

As a result, students continuously negotiated whether they should take risks or move in a direction contrary to Natalie's expectations at the risk of earning a lower grade, negotiating between the two cultures of studio and design and the culture of education and grading. John mentioned:

> *And you do something, you risk it, right? Are you going to get shut down for it because you risked it and you didn't listen to [your instructors], you know? It's always that fear, because in the end they have the ultimate power, because they have your grades. And I think we value our grades way too much, but that's the system that we were brought up in.* (John, 18 November).

Individuality and uniqueness

A culture of experimentation and risk-taking also promoted individuality and uniqueness, and finding a "personal voice" in the AD 1 studio. Although students supported

each other as a community of learners, I also noticed that students also compared their work against each other and sought uniqueness to give their work identity. "*Showing your individual style shows your passion,"* said Kendra. Some students criticized their peers for "playing it safe" or not pushing the boundaries. Tim said:

> *Some people are trying to be too safe. They want to make buildings that work. That's good, and we have to get to that point, but I felt like, since it was our first studio, ever, in architecture, that's not what we should be doing. We shouldn't ... Our goal isn't in this class to make a building that works perfectly, it's more that we have a really awesome concept.* (Tim, 8 December)

Instructors and visiting critics also communicated that "making a statement" with a design was the role of an architect. I commented in a field note:

> Reviewer 1 says "Let me take a different route, and see if I can entrap you there. My understanding of architecture's task is to make a statement about space, have an attitude about domestic space." Reviewer 2 adds, "You need to take a position about infill buildings, public space, etc. as an architect. You need to take a stance. Name one thing that is super important about your design." Brady replies that it is the pathway, which he wanted to keep and make it a public space. "This is what you'll face," Reviewer 1 responds. "Everyone will ask you to take a position. Your problem is you got caught up in reality and it killed your design. What is your position of domesticity? Take the opportunity to show us something different." (Field note, 7 December)

Many students felt that their peers who had the most unique designs were the most successful students in the AD 1 course. Others felt that in order to be successful they had to make bold statements. Jon said:

> *I want to be…I want to make big buildings. Not big, but I want to have buildings that I can design for myself. That is incredibly important to me and that's what motivates me. It's not necessarily just the fact that I want to do something, I want to make things. I want to make. I want to make, I want to walk and be like, "I did this…" not to tell people that I did it but because I want to appreciate what I did. I want to, I like making, actualizing them. I can only actualize things as an architect if I'm one of the best* (Jon, 8 December).

However, some students felt pressured to have unique work that stood out among their peers, and felt conflicted with the emphasis on uniqueness with wanting to have "realistic" work. Peter remarked:

> *I don't really know what it means to be a successful architect. Like, I feel like there are different ways to look at that. See, if you have very like high-art architecture and stuff like that, they definitely have a different opinion than people who are more structural and want things to work well together. And I want to be one of those architects that is more structural, just because the high-art stuff, a lot of times is like, give me a break, dude! It's not realistic, that doesn't ...it's not my thing. Which scares me. I feel like there's a lot of pressure to be that way [in architecture school]*. (Peter, 13 November)

Ultimately, students felt that finding their own voice and purpose in their work made them successful architecture students and ultimately, successful architects. *"I feel like, if I'm going to be a great architect, it has to be me…"* Tim reflected.

Intersection with affordances

The physical, structural, and pedagogical affordances of the AD 1 studio environment supported a culture of experimentation and risk-taking in a variety of ways. Dedicated desk spaces allowed for students to have a "home base" for uninterrupted private design activity, while the open layout and working in proximity afforded extended space for experimentation and collaborations. The structural affordances of AD 1, namely the project briefs, allowed students to push against the constraints which served as a catalyst for their creativity. The pedagogical affordances of the critiques transmitted understandings that experimentation and risk-taking were important to the creative process, and that making bold statements and challenging convention were traits of a successful architect.

Physical. Dedicated desk spaces afforded a workspace where students could experiment with various materials and representations of their work. The desks included a surface space where students worked on drawings or models, lockable drawers for supplies, and a vertical portion of the desk behind the table top where students hung drawings and other class-related and personal artifacts. Students mentioned the dedicated desk spaces afforded a personal space to work on their projects interrupted and the ability to reference changes in their work as they progressed.

The open layout of the studio included a large central table where Natalie sat during class time, or where students and Natalie would congregate during mini-lectures and demonstrations. The rest of the time the central table was open for students to use if they needed extra space to work collaboratively or construct a larger model that would not fit on their own desk. Tim said:

> *There's like one big table [in the middle of studio], so that's kind of nice… it's nice having that central table to just lay out our work and have group discussions and being able to, like, because some people actually do their work on that table in the evenings, so it's cool because then you can see what they're doing and stuff like that. [It's easier to see others' work at central table] because it's more open, when you walk by.* (Tim, 14 September).

Thus, the open layout of the studio and working in co-location with their peers afforded students space for making representations and experimenting with materials beyond their own personal work stations. The open layout and working in co-location also intersected as a space where students could collaborate with others to extend their own ideas and making beyond their own ideas and skills.

Structural. The structural affordances of AD 1, in particular the alignment of course between AD 1 and the other courses in the curriculum, helped students make connections in

their understanding of design representations and how they communicate design ideas externally. Students gained understanding of the role of various representations in their non-studio courses, and then experimented with materials to create those representations for their projects in AD 1. For example, Jon described learning how to do axonometric drawings in his building communications course, and then experimenting with versions of the rendering in studio, helped him successfully communicate his final project for AD 1.

> *I did an axon drawing, I learned how to do that. I learned how to add color to it on the computer, which is something I'm going to do for every project moving forward. Do an axon drawing, explode it, add circulation, show program, show structure in that drawing is an excellent way, for me I felt was a very successful way, of showing that in addition to having a board with final facade renderings, and a floor plan. If I was to go forward, I think, in future reviews you'll see a very similar setup unless I need to change something. I don't know if that's a bad thing because then I'm always going to be the same. But probably with an added twist.* (Jon, 8 December).

The AD 1 projects also intersected with an experimental and risk-taking culture of the studio. All students in AD 1 were working within the requirements and constraints of the same project brief, yet took individual approaches to solving the design situation of the brief. Students recognized the constraints on the projects enhanced their creativity; they pushed against the constraints through experimenting with materials and taking conceptual risks to come up with unique and novel solutions to the design problem. Students also recognized the project constraints limited their options, which served as a catalyst for their ideas. *"Sometimes constraints can limit you, but constraints also focus you*," Brady said. *"They allow you to be more, allow you to be more creative because you have to think of solutions to the problem."*

Pedagogical. The pedagogical affordances of the critiques and mini-demonstrations also supported a culture of experimentation and risk-taking. It was clear that the feedback by visiting critics in the final reviews prioritized taking risks and making bold choices. The dialogue in the final reviews transmitted a message to students that the role of the architect is to push the boundaries of convention and make a statement with the design.

Less formal reviews, such as desk crits and pin ups also intersected with a culture of experimenting and risk-taking. The desk crit afforded a pedagogical space where tacit design knowledge was passed from the instructor to the student through showing and telling. Since Natalie prioritized process work and experimentation with materials, much of her feedback was focused on how students manipulated materials and used them to represent aspects of their designs. Her students in turn equated experimentation and risk-taking, and ultimately individuality and uniqueness, with success in AD 1.

Summary

Students of architecture engage in inquiry learning though making representations of built structures. These representations are central inputs to the thought process, and executing and managing them are the central skills of designing (Larson & Dorst, 2009). In AD 1, experimentation with various forms of representation, in drawings, diagrams, and models, enabled students' design ideas to change and evolve. Students equated working by hand with being able to experiment and take more risks with their design ideas. AD 1 students spoke frequently that encouragement to take risks and to try new things also helped them learn. However, a culture of experimentation and risk-taking could be at odds with a culture of education based on grading and assessment. The culture of experimentation and risk taking

in AD 1 was also equated with individuality and uniqueness, which were perceived by students as the most valuable traits of a successful architecture student.

The physical, structural, and pedagogical affordances of the AD 1 studio environment supported a culture of experimentation through dedicated desk spaces, open layout and working in proximity. The structural affordances of the project briefs, allowed for students to push against the constraints which served as a catalyst for their creativity. The pedagogical affordances of the critiques transmitted understandings that experimentation and risk-taking were important to the creative process, and that making bold statements and challenging convention were traits of a successful architect.

Summary

To answer Research Question 2, I investigated the ways in which characteristics of studio culture intersect with the affordances of Architectural Design 1 in how students made meaning of their architectural learning and development as architectural professionals. Four characteristics of studio culture as defined by the literature—(a) a community of learners and architects; (b) centralizing feedback; (c) unscheduled design activity; and (d) experimentation and risk-taking—intersected with the physical, structural, and physical affordances of the studio identified in RQ1 and illustrated how students made meaning of their learning and development as architects.

The learning culture of the studio allows students freedom to express and exchange ideas while socializing (Samsuddin, 2008). The physical, structural, and pedagogical affordances of the studio leveraged a feeling of community and belonging for the students in AD 1**.** The studio space of AD 1 had a casual and social student atmosphere. Students

described the environment of AD 1, “social”, “casual”, “relaxed”, and “a fun place to learn” and supported each other through sharing ideas, tools, and approaches which encouraged and motivated students to stay engaged in their learning. Students spoke of feeling a sense of community and belonging in the studio as early as the second week of the course. The physical affordances of an open layout and proximity to others allowed for frequent social interaction, resulting in close relationships between peers. Alignment between the courses and a cohort learning model also contributed to a feeling of community. Daily desk crits afforded for regular one-on-one interaction between Natalie and her students, resulting in an informal learning atmosphere in AD 1 which felt more authentic to students than other non-studio learning environments.

The nature of dialogue in the architecture studio centers around feedback through one-on-one communication between the students and their instructors and peer-to-peer interactions (Dannels et al, 2011). In AD 1, accepting and analyzing feedback was seen as critical to learning and success as an architecture student. The open layout and students working in proximity helped facilitate feedback among peers. Long hours in the studio afforded breaks away from focused work where students would interact and offer feedback to others. Critiques in all their forms were the pedagogical vehicle for feedback in AD 1. Desk crits facilitated instructor-student feedback, while pin-ups afforded the modeling of effective critique feedback. Students’ listening in on peers’ feedback from instructors afforded learning how others’ wrestle with problems and create solutions which would help them be successful with their own tasks.

The main use of studio is dedicated to untimetabled design activity (Lawson & Dorst, 2009). Students in AD 1 engaged in individual design activity for long hours at a stretch,

both during studio time and on the evenings and weekends. Students in AD 1 experienced a blurred boundary between "studio" and "non-studio" time, making little distinction between scheduled "class" time and their personal work time. Natalie emphasized process and production in her teaching and grading, and students felt strongly that time to generate and reflect on their designs in iterative cycles of process helped them learn. Students in AD 1 also equated time with dedication to architecture, acknowledging that being a successful architecture student means being present in studio to work on and refine their designs. The physical affordances of dedicated desk space and working in proximity supported students untimetabled design activity. Dedicated desk space afforded students the opportunity of uninterrupted production and "pin up" space to reflect on how their work changes over time. Students' working in proximity eliminated the isolation of working for long hours. Structural affordances of long hours devoted to studio afforded the ability for students to work at their own pace and provided opportunities for them to learn how to self-manage their time and monitor their own progress; the quick pace of the projects and their deadlines afforded rapid iteration and decision-making, and allowed projects to move forward through repeated iterative cycles and incremental growth. Pedaogical affordances of regular desk crits supported iteration and change, and development of ideas over time.

Students of architecture engage in a "conversation with the materials" of designing though making representations of built structures in (Schön, 1983, p. 175). These representations are central inputs to the thought process, and executing and managing them are the central skills of designing (Larson & Dorst, 2009). In AD 1, experimentation with various forms of representation, in drawings, diagrams, and models, enabled students' design ideas to change and evolve. Students equated working by hand with being able to

experiment and take more risks with their design ideas. AD 1 students spoke frequently that encouragement to take risks and to try new things also helped them learn. However, a culture of experimentation and risk-taking could be at odds with a culture of education based on grading and assessment. The culture of experimentation and risk taking in AD 1 was also equated with individuality and uniqueness, which were perceived by students as the most valuable traits of a successful architecture student.

The physical, structural, and pedagogical affordances of the AD 1 studio environment supported a culture of experimentation through dedicated desk spaces, open layout and working in proximity. The structural affordances of the project briefs, allowed students to push against the constraints which served as a catalyst for their creativity. The pedagogical affordances of the critiques transmitted understandings that experimentation and risk-taking were important to the creative process, and that making bold statements and challenging convention were traits of a successful architect.

Revisiting Assumptions, Potential Biases, and Addressing Limitations

It is useful at this point in the chapter to revisit my assumptions entering into this research as well as my positionality to address any potential limitations and biases that would affect the transferability of the findings of this research to different contexts. Each is addressed based on my prior assumptions and findings synthesized after gathering data and analyzing the findings.

Assumptions

In Chapter 1, I stated my assumption that students would assign different meanings to the objects, events, and social interactions in the studio environment and that studio culture

would intersect with how students made meaning of these interactions. I found this to be true to a limited extent. Although the nine students who participated in this study did assign different meanings to various interactions in the studio environment, I was surprised at how similarly students interpreted the meanings of the affordances of the studio and their common definitions of studio culture.

For example, almost all the students honed in on the affordances of the physical space of the studio in the beginning of AD 1. This is perhaps due to the fact that architecture itself is the study of physical space (both built and natural) and human behavior, so students were naturally aware of how the physical attributes of their learning space afforded social interaction and aided their learning. Students were less in agreement about the affordances of the structural aspects of studio, particularly in their perceptions of the structure of the curriculum, course, and the projects.

In addition, I discovered the student participants in this study had pre-conceived notions of the characteristics of "studio culture" in architecture prior to entering into their first studio learning experience, and these notions of studio culture were extremely similar. Although all the participants in this study had one year of general art and design education prior to AD 1, it was not in architecture nor was it in a dedicated space with a cohort of students with the same curriculum, projects, etc. I asked students to define studio culture in architecture in their first interview with me; from the second week of AD 1 students were mentioning aspects like "community", "social", "all-nighters", and "competition". These beliefs and assumptions about studio culture in architecture were, I suspect, passed down from peers and previous students, or are myths and rituals perpetuated through the lore of

architectural education, although investigating the origin of students' perceptions of studio culture is outside the bounds of this study.

Potential biases

Certain biases are inherent to the qualitative approach and ethnographic method in which this study was conducted. Issues of reliability and validity as outlined in Chapter 3 were followed to control for potential biases that may have become present in the implementation and analysis of the data. In the course of conducting this research, however, I also encountered potential biases that are important to address.

Issues of power relationships between myself and the student participants warrant mention. In the early weeks of AD 1 students addressed me as "Natalie's teaching assistant", despite my near constant reminder of my role as a researcher-participant in the course. The fact that students perceived me to be in a position of authority may have resulted in self-selection bias regarding what students relayed to me about the social interactions in the studio and in their reflections on their learning in AD 1. However, the student participants also established close, personal relationships with me during the course of AD 1 which resulted in sharing certain information that I believe they would not have shared with their instructor; I keep these conversations confidential.

Likewise, I shared personal stories about my background and postionality with the students, and some conversations resulted in my continued interactions with participants in an informal mentorship role after data collection commenced. Reciprocal sharing relationships aim to reduce the power differences between the researcher and the study participants (Esterberg, 2002). Although these perceptions and relationships may have the

potential for introducing bias, I felt establishing an equitable, reciprocal relationship with the study participants was important in conducting this research in an ethical manner.

Limitations

The uniqueness of the AD 1 studio environment may also be considered a limitation of this research. For example, Natalie's emphasis on process and her informal nature in which she interacted with her students may be unique to her own personality and teaching style. Natalie also noted that students in this particular studio of AD 1 appeared more social than in previous semesters she had taught the course. Although this study was delimited as an intrinsic case study (Stake, 1995) around one particular architecture course, I stressed that the findings in this research are particular to the unique experiences of the participants in this study and their educational context; transferability to other contexts is best judged by the reader.

It is also important to note that many of the behaviors and interactions that were integral to students' development during AD 1 happened outside of scheduled studio "class" time, as evidenced in the blurred boundaries between students' work and personal time. The students cited important interactions in the studio environment from when they were working late into the evening or early in the morning. For many reasons I was not able to conduct frequent studio observations of class time although I did try to be present late at night during pivotal times in the semester (prior to important deadlines or final critiques, for instance). This is a limitation of the data collection in this study.

Finally, although I did not approach this study through a critical lens, I noticed issues of power and positionality among participants in this study that warrant mention. I was

witness to acts of microaggressions and harassment in the studio environment among the student participants, particularly aimed at certain students' social identities. The informal student culture of the studio environment may have lent itself to casual interactions which revealed students' unconscious bias toward their peers. Additionally, Natalie shared with me that she felt her students had a lack of respect for her feedback because of her gender and frequently sought out a second opinion from a male instructor, which I also observed to be true.

> *But me being a woman, I know it's true, because of comments that I've heard and even when you observe the way [students] treat other male professors. You'll find other female [architecture] professors say the exact same thing as I'm saying. Yes, the way [students] have that lack of respect for what you're saying. They don't think it holds weight as much as, say, a second opinion from a male professor* (Natalie, 6 October).

I also heard frequent instances of gender bias in how students discussed female professors versus male professors during my time in AD 1. Researchers (Anthony, 2002; Bell, 2015; Frederickson, 1993; Ahrensen & Groat, 1992; to name a few) have drawn important attention to issues of gender and racial biases in architecture education and, given that I was witness to these same biases, the lack of a critical lens of studio culture in this study may be considered a limitation of this research.

Summary

This ethnographic case study was conducted to provide a rich description of the learning environment of a studio course to explore how interactions in the studio environment shape students' understandings and behaviors as they learn the fundamental elements of architectural practice. My assumption was that students assign different meanings to the objects, events, and social interactions in a studio environment, and studio

culture intersects with how students make meaning of these interactions, shaping their understandings of the practice of architecture.

I employed an ecological lens to focus my case-based inquiry on two main questions: (1) What are the physical, structural, and pedagogical affordances of the studio learning environment in Architectural Design 1? and (2) In what ways do characteristics of studio culture intersect with the affordances of Architectural Design 1 in how students make meaning of their architectural learning and development as architectural professionals?

The *physical affordances* of the open layout of the studio space, combined with the public nature of the desks/workspaces as a space for students to personally exhibit their work in progress, afforded frequent feedback and conversations surrounding the design process. Students equated the "flow" of people through the studio space, and the social interactions the flow afforded, an essential part of building community in the studio and pivotal to their learning and their identity as an architecture student. Dedicated desk space afforded students the opportunity of uninterrupted production, space to reflect on how their work changes over time, and a sense of belonging to the architecture department. Working in proximity to other students and studios afforded frequent feedback, comparing and self-assessing and monitoring learning and performance.

The AD 1 *structure afforded* long blocks of unscheduled work time and the opportunity for students to self-manage their time and progress, which many felt mimicked authentic architectural practice. The horizontal alignment between AD 1 and other courses in the curriculum afforded multiple learning opportunities to build upon and apply their knowledge and allowed students to feel that what they are learning is relevant to their development as architects. The project brief afforded a lens through which to 'see' the

problem and visualize different design solutions, as well as a guide to evaluate solutions to determine their value; project constraints acted as a catalyst for ideas. The sequencing of the three projects in AD 1 afforded cyclical learning and sequencing of the tasks and deadlines within the projects allowed students to experience the design process in stages, and emphasized productivity, rapid iteration and decision-making.

The *pedagogical affordances* of AD 1 included formal and informal critique interactions. Desk crits and pin-ups afforded the transmission of tacit design knowledge through reciprocal showing and telling and allowed for reflection, iteration, and exploration. Pin-ups held the added affordance of public coaching, demonstrating, and modeling for students to learn the practice of critique dialogue. Formal critiques focused on presentation and external communication. Interim and final reviews afforded a space for practicing the dialogue of architectural practice. The interim review also afforded formal-formative feedback. The final review afforded the performance of "selling" their design to external audiences, while peer-led final reviews afforded direct and judgmental feedback, and encouraged metacognition and reflection on process. Mini-lectures and demonstrations were also pedagogical affordances. Demonstrations allowed for the modeling of design thinking, making procedural knowledge visible.

Four characteristics of studio culture as defined by the literature—(a) a community of learners and architects, (b) centralizing feedback, (c) unscheduled design activity and (d) experimentation and risk-taking—intersected with the physical, structural, and physical affordances of the studio identified in RQ1 in how students made meaning of their learning and development as architects. The learning culture of the studio allows for students to have freedom to express and exchange ideas while socializing (Samsuddin, 2008). The physical,

structural, and pedagogical affordances of the studio leveraged *a feeling of community and belonging* for the students in AD 1**.** The studio space of AD 1 had a casual and social student atmosphere. Students described the environment of AD 1, "social", "casual", "relaxed", and "a fun place to learn" and supported each other through sharing ideas, tools, and approaches which encouraged and motivated students to stay engaged in their learning. Students spoke of feeling a sense of community and belonging in the studio as early as the second week of the course. The physical affordances of an open layout and proximity to others allowed for frequent social interaction, resulting in close relationships between peers. Alignment between the courses and a cohort learning model also contributed to a feeling of community. Daily desk crits afforded for regular one-on-one interaction between Natalie and her students, resulting in an informal learning atmosphere in AD 1 which felt more authentic to students than other non-studio learning environments.

The nature of dialogue in the architecture studio *centers around feedback* through one-on-one communication between the students and their instructors and peer-to-peer interactions (Dannels et al., 2011). Accepting and analyzing feedback was critical to learning and success as an architecture student. The open layout and students working in proximity helped facilitate feedback among peers. Long hours in the studio afforded breaks away from focused work where students would interact and offer feedback to others. Critiques in all their forms were the pedagogical vehicle for feedback in AD 1. Desk crits facilitated instructor-student feedback, while pin-ups afforded the modeling of effective critique feedback. Students' listening in on peers' feedback from instructors afforded learning how others' wrestle with problems and create solutions which would help them be successful with their own tasks.

The main use of studio is dedicated to *untimetabled design activity* (Lawson & Dorst, 2009). Students in AD 1 engaged in individual design activity for long hours at a stretch, both during studio time and on the evenings and weekends. Thus, students in AD 1 experienced a blurred boundary between "studio" and "non-studio" time, making little distinction between scheduled "class" time and their personal work time. Natalie emphasized process and production in her teaching and grading, and students felt strongly that time to generate and reflect on their designs in iterative cycles of process helped them learn. Students in AD 1 also equated time with dedication to architecture, acknowledging that being a successful architecture student means being present in studio to work on and refine their designs. Dedicated desk space afforded students the opportunity of uninterrupted production and "pin up" space to reflect on how their work changes over time, and students' working in proximity eliminated the isolation of individual work time. Structural affordances of long hours devoted to studio supported students' ability to work at their own pace and provided opportunities for them to learn how to self-manage their time and monitor their own progress; the quick pace of the projects and their deadlines afforded rapid iteration and decision-making, and allowed projects to move forward through repeated iterative cycles and incremental growth. Pedaogical affordances of regular desk crits supported iteration and change, and development of ideas over time.

Finally, learning to design involves a "conversation with the materials" in the studio (Schön, 1983, p. 175) levied by a culture of *experimentation and taking risks* with various forms of representation. In AD 1, experimentation enabled students' design ideas to change and evolve, and students felt encouragement to take risks and to try new things also helped them learn. However, a culture of experimentation and risk-taking could be at odds with a

culture of education based on grading and assessment. The culture of experimentation and risk taking in AD 1 was also equated with individuality and uniqueness, which were perceived by students as the most valuable traits of a successful architecture student. The physical, structural, and pedagogical affordances of the AD 1 studio environment supported a culture of experimentation through dedicated desk spaces, open layout and working in proximity. The structural affordances of the project briefs enabled students to push against the constraints which served as a catalyst for their creativity. The pedagogical affordances of the critiques transmitted understandings that experimentation and risk-taking were important to the creative process, and that making bold statements and challenging convention were traits of a successful architect.

This chapter presented the findings of examining the affordances of the studio environment by physical space, structure, and pedagogy, and addressed the ways characteristics of studio culture intersected with these affordances, by organizing the data from the various sources into themes. Chapter 5 will focus on providing interpretive insights to these findings.

CHAPTER 5. DISCUSSION

This ethnographic case study was conducted to provide a rich description of the learning environment of a studio course to explore how interactions in the studio environment shape students' understandings and behaviors as they learn the fundamental elements of design and architectural practice. Using a conceptual framework of affordances (Gibson, 1979; Greeno 1994), I described the various ways the studio environment creates opportunities for social interaction, and how characteristics of studio culture intersects with the affordances of the studio environment in how students make meaning of their learning. The knowledge generated from this study helps to understand the role of the studio environment in supporting students' architectural knowledge and identity, and provide insight into how individual-environment interactions shape how students make meaning of their learning experiences.

A critical review of the literature informed the conceptual frameworks for this study. First, the study drew upon Gibson's (1977) ecological theory of affordances focusing on the interactions of the learner with the social and physical elements of their environment in how the learner makes meaning. Second, literature on the history and characteristics of studio culture was reviewed to provide a context for the everyday actions and rituals of studio learning. I posited that studio culture norms are tacitly transmitted via the instructors to the students, or among the students themselves, through everyday actions in the studio learning space and intersect with the affordances of the studio, either supporting or hindering the affordances for learning in the studio environment. Literature pertaining to previous ethnographic studies of studio learning was also reviewed to examine the relationship

between pedagogical structures and social interactions of the studio in how students understand design knowledge, conventions, and values of the profession.

Data for this study came from the semester I spent as a participant-observer in Architecture Design 1, a beginning architecture course in a college of design at a large, public university. Participants in this study included nine current undergraduate students in their first year of study leading to a Bachelor of Architecture (B. Arch) degree and their studio instructor. The data included field notes from approximately 106 hours of studio observations, 39 in-depth interviews, course-related documents and materials, and my own reflections on studio visits. The data were coded, analyzed, and organized by research question and then by categories and subcategories guided by the conceptual framework (Bloomberg, 2012).

The discussions presented in the sections that follow align with the purpose of the study and the research questions. Chapter 4 presented the findings of examining the affordances of the studio environment by physical space, structure, and pedagogy, and addressed the ways characteristics of studio culture intersected with these affordances, by organizing the data from the various sources into categories. The purpose of this final chapter is to provide insights to the findings. While the previous chapter separated the data into pieces, this chapter represents these findings by forming an integrated picture. This layered synthesis of the findings illustrates the complexity of the studio learning environment in architecture in a more holistic way (Bloomberg & Volpe, 2012).

The discussion also addresses the literature on affordances, studio culture, and studio learning environments. The implications of these findings are intended to richly describe the learning environment of a studio course by illustrating the ways social interactions in the

studio environment shape students' understandings and behaviors as they learn the fundamental elements of design and architectural practice. The goal is to understand the role of the studio environment in supporting students' architectural knowledge and identity, and provide insight into how individual-environment interactions shape how students make meaning of their learning experiences. This final chapter of the dissertation research also offers implications for practice and recommendations for future research. A summary and final reflection concludes the chapter.

Summary of the Findings

The physical affordances of the studio environment included an open layout, public/private workspaces, and co-working in proximity to others. The structural affordances were long blocks of unscheduled work time, alignment between AD 1 and the other courses in the curriculum, and the project brief, and the sequencing of the projects, tasks, and deadlines. The pedagogical affordances were formal and informal critique, mini-lectures, and demonstrations. Four characteristics of studio culture as defined by the literature—(a) a community of learners and architects, (b) centralizing feedback, (c) untimetabled design activity, and (d) experimentation and risk-taking—intersected with the physical, structural, and physical affordances of the studio identified in RQ1 in how students made meaning of their learning and development as architects.

Research Question 1: What are the physical, structural, and pedagogical affordances of the studio learning environment in Architectural Design 1?

The first research question sought to identify the affordances for learning and social interaction of each of these environmental dimensions: (a) physical space, (b) curricular

structure, and (c) pedagogical method. Gibson (1977, 1979) defined affordances as the possibility for action formed by the relationship between an individual and their environment; "the affordances of the environment are what it offers the animal, what is provides or furnishes, either for good or ill" (1979, p. 127). To better understand the concept of affordances within the context of learning, Greeno (1994) placed affordances in situativity theory. Situativity theory refers to frameworks which posit that knowledge, thinking, and learning are situated in experience (Nathan & Sawyer, 2014). Within this view, Gibson's concept of affordances is key. In any interaction between a learner and another system (e.g., physical, social), the conditions that enable these interactions include properties of the learner and the other system. Affordances, therefore, refer to whatever it is about the environment that contributes to the interaction that occurs (Greeno, 1994). Gibson's (1997) theoretical concept of affordances, as extended by Greeno (1994), was applied to this study to identify the qualitative properties of the spatial, structural, and pedagogical characteristics of the AD 1, in conjunction with participants' actions within the AD 1 environment, that enable or constrain social interactions for learning.

Physical

The properties of the physical space of the design studio afford important student learning behaviors. Mohanan (2002) stated that built environments afford conditions of practice, and that these affordances embody educational values that translate to learning activities. The open layout of the studio allows for a flow of people and ideas through the space. In my observations of AD 1, students and faculty frequently migrated in, across, and out of the studio space; peers and instructors would stop in the space to observe students'

work, engage in conversation or an informal critique, and then move on. This flow allowed for frequent social interaction and an exchange of ideas and solutions to design problem among peers and instructors and students. This collaboration during the design process maps a professional practice that is necessarily highly collaborative, especially when new professionals need to ask questions or listen in to learn how design projects should be completed. Open studios teach students how to use their peers as a resource to learn on their own. Thus, open studio layouts lend themselves to *fluidity*, which Mohanan identified as a key property of constructivist learning environments. Students in AD 1 equated the flow of students and faculty through the studio space, and the social interaction it affords, as an essential part of building community in the studio and pivotal to their learning and their identity as architecture students. Dedicated desk space affords a space for uninterrupted work as well as personal exhibition space where work in progress can be referenced to witness how designs change over time. In AD 1, the dedicated desk spaces allowed for a private work environment, or a "home base" for working free from disruption. Large, dedicated work spaces also afford experimenting with materials and encourages unexpected creative connections. Importantly, students in AD 1 equated their personal desk space with belonging to the architecture department and increased their motivation to work. The dedicated desk space also has a public component; because students' work is on display at their stations, peers view students' work in progress and offer feedback. In AD 1, displaying work in progress was an important entrée to starting conversations, comparing approaches, and sharing ideas. This combination of private and public in AD 1 appeared to be extremely important in the development of students' design ideas and in the progression of their design learning. In creative activity, early ideas can be fragile and easily negated by critical review,

yet students often want to test out their ideas on their peers to get feedback; controlling the public and private function of the workspace is therefore a vital property of the studio learning environment (Lawson & Dorst, 2009).

Students' co-location in studio and ability to work in proximity to other studios offered perhaps the most important affordances for social interaction and learning. The shared workspace of the studio affords collaboration and allows students to easily share ideas and gain feedback. Working in co-location in the studio affords students the ability to observe their peers' approaches to solving design problems, to casually and informally discuss design in process, and compare their own progress and learning against their peers. Shreve et al. (2010) and Morton (2012) stated that the use of space in studio learning for "shared, prolonged, communal activity" (Shreve et al, p. 133) is fundamental to students' engagement in design practice and learning how to 'do' design. I also found this to be true of AD 1; students strongly felt that working together in a shared environment kept them motivated to work and learn and stay engaged in the course.

Perhaps unique to the AD 1 context was the fact that all the sections (or "studios") of AD 1 were offered in the same physical space. This proximity of the studios to each other afforded students the ability to collaborate and exchange ideas with a wider group of peers. I saw many instances where students across different studios helped each other through sharing ideas and tools, teaching each other specific techniques and processes, and offering feedback. Proximity also afforded students to form relationships with and seek advice from other AD 1 instructors, resulting in a team-teaching approach. This frequent social interaction led to a feeling of community among students, that they were active participants in their learning along with all AD 1 instructors. Thus, co-location of students and

instructors in the studio environment inherits the quality of the 'community of scholars' or scholastic guilds of the earliest universities (Lawson & Dorst, 2009).

Despite the affordances of the physical space of the studio, scholars have paid little attention to the physical studio space within architecture education. This lack of attention is likely due to the physical layout of the studio which is ubiquitously associated with architectural learning; the design of the studio space has changed very little since its beginnings in the École des Beaux-Arts in the 19th century (Anthony, 2012). This study showed, however, that the studio space itself plays a pivotal role in students' architecture learning and development and warrants further empirical attention.

Structural

The structure of studio includes the curricular hours of the studio course, the pacing, and sequencing of the projects and other learning opportunities, and the alignment of the studio course with other courses in the curriculum. Studio courses are characteristically scheduled for long blocks of time, usually half a day, multiple times a week (Cennamo & Brandt, 2012). Most these hours of studio are left unscheduled for students to work on their design projects. Lawson and Dorst (2009) argue that design is an activity that cannot be scheduled, nor can it be predicted how long a phase of designing will take. In AD 1, long blocks of studio afforded students time to experience the ebbs and flows of their own design process and to learn how to manage their productivity accordingly. The long hours of studio also felt authentic to architecture practice. Students stated the long hours of studio AD 1 felt "like a job" and learning how to manage their work and time were both a trait of a successful architecture student and a valuable skill for a practicing architect.

The structure of the AD 1 course allowed for scaffolded instruction, moving students toward understanding and independence in the learning process. In many ways, the studio learning environment is like project-based learning (Krajcik & Blumenfeld, 2006), a learning-sciences based curriculum in which learners explore a 'problem' to be solved by participating in authentic, situated inquiry through processes central to the discipline. In project-based learning, students' learning activities are scaffolded in ways that help them participate in activities just beyond their ability (Krajcik & Blumenfeld). The design of the projects in AD 1 afforded the transfer of learning from assignment or project to the next that not only deepened students' understanding but also mimicked the design process. For example, each assignment in Project 1 (e.g., "Extrapolate", "Iterate and Create", "Reflect, Refine, and Redraw") moved students through actions associated with stages of the design process, and students were instructed to reflect on the previous stage and identify insights to use in the next stage of the design. Shaffer (2003) noted that studio learning commonly progresses students through a series of exercises that revisit a central problem in progressively more detail. The sequential nature of the assignments and tasks within the projects allow students to experience and understand how to solve a problem systemically and experience how a design idea evolves over time.

The sequencing of the three projects in AD 1 also afforded scaffolding. The projects were designed so that the learning from Project 1 was intended to be applied to Project 2, and the learning from Projects 1 and 2 applied to the comprehensive design of Project 3. By Project 3, students were choosing to interact with Natalie less often, relying instead on their own intuition to guide them through their decision-making during the most comprehensive and complex project in AD 1. In the architecture curriculum, similar design 'problems' are

presented repeatedly over time but with increasingly more detail and complexity (Lawson & Dorst, 2009; Sawyer, 2012). In the beginning of the curriculum, elements of the design process are slowed down or attenuated, so students learn how design ideas form. Then, the projects are repeated so that over time students rely less on overly analytical thinking and more on intuitive knowledge through repeated practice. Learning sciences research has found that the most effective constructivist learning environments engage in authentic, situated inquiry practices but are also highly constrained (Sawyer, 2012). The constraints outlined in the project briefs in AD 1 served an important purpose for enhancing students' thinking and problem-solving; many mentioned wanting to "limit" themselves (Tim) or that having constraints "made the [ideas] go faster because you have…a beginning" (John). The site and client constraints outlined in the project brief also mimic what would be found in professional practice; finding solutions within extremely tight limitations is central to architecture practice. As the projects become more complex, students learn over time to accept these tight constraints and work within them.

Studio courses tend to be prioritized over academic and non-studio courses due to the large number of curricular hours studio holds in the wider design curriculum (Cox, et al 2008). In the case of AD 1, there was a conscious effort by college faculty to align the projects in AD 1 with the content being taught in other courses in the first-year architecture curriculum. The alignment of AD 1 with other courses in the curriculum afforded students multiple opportunities to build on and apply their knowledge across all their courses, allowing students to make connections in their architecture understandings. Many forms of curricula do not help students understand the contexts in which their knowledge will be useful. Horizontal alignment between studio and the wider curriculum affords the

conditionalization of knowledge gained from courses across the curriculum by allowing students to experience how their knowledge is useful in solving design problems (Bransford et al., 2000). Alignment of the studio course with the wider curriculum also allows students to integrate their knowledge from other courses. Lawson and Dorst (2009) state that design solutions are often "integrated responses to multiple complex sets of requirements, specifications, demands, needs, and feelings" (p. 234). The studio is designed to afford integration of knowledge and ideas from many subjects while introducing knowledge and ideas of its own (Lawson & Dorst).

Pedagogical

The pedagogical affordances of the studio allowed for a reciprocal 'showing and telling' dialogue between students and their instructors, or between the students themselves, which aided in students' learning. Students stated that watching their instructors demonstrate the act of designing, and listening while they explained their thinking, was vital in helping them learn. The desk crit was the main pedagogical vehicle for this reciprocal dialogue in AD 1 and was cited by the students as having the most effect on their learning. This is not surprising given the empirical attention that has been paid to the effectiveness of desk crit in design learning (Schön, 1983; Cennamo & Brandt, 2012b; Scrand & Eliason, 2012). However, the affordances of how Natalie structured the pin-up critiques in AD 1 were as impactful for students as the individual desk crits for two important reasons: (a) Natalie's modeling of the language and activity of critiquing others' work, and (b) the opportunity for students to witness how others wrestled with the complexity of the projects and tasks.

Cennamo and Brandt (2012) argued that the value of pin-ups, especially when students are struggling to make design decisions, cannot be understated.

Students' participation in final reviews afforded the performance of the language of design and served as an important socializing function. Similar to Oak (2011), I also found that students felt learning how to "sell" their design to the reviewers in the final review was equated to being a successful as an architect who must ultimately sell their designs to a client. Likewise, the formal, public interim and final critiques also afforded students the understanding that, to successfully "sell" their design solution, the students must have alignment between what they are verbally describing and what others see in the presentation of the design. As one instructor stated, "…anytime you talk about [an idea], you need visuals to claim it," further exemplifying that a fundamental characteristic of studio learning in architecture is that a learner's developing understandings are externally represented (Saywer, 2012). Thus, final reviews are both a performance rehearsal for communicating professionally and an assessment of the match between students' intentions and the final product. Although I found the final critique to afford valuable actions for students to publicly perform their roles as architects (Dannels, 2005; Shulman, 2005), the literature on final reviews has been critical. For example, final critiques have been seen as perpetuating hegemonic displays of power of instructors over students (Webster, 2007), which silences students and isolates them from the discourse (Percy, 2004). These contrary views of the final critique reveal the importance of a closer look at the ways critiques transmit tacit understandings about architectural identity and practice.

Finally, mini-lectures and demonstrations afford pedagogical space for faculty to teach skills specific to architecture practice. Technical and analytical skills were taught

through these lectures and demonstrations, and often scheduled opportunistically when Natalie noticed her students wrestling with a question or problem in the course of their project work. For example, Natalie asked Instructor E to come to her studio to give a short lecture on site and program analysis when she noticed students' struggling with the early stages of Project 3 – this activity, like all of the lectures and demonstrations in AD 1, were not outlined in the course syllabus. Such responsive teaching requires a high-degree of pedagogical content knowledge and sensitivity, intuitively knowing when to step in to provide explicit instruction (Sawyer, 2012; Shulman, 1986).

Summary

The first research question sought to identify the affordances for learning and social interaction of each of these environmental dimensions of the architecture studio: (a) physical space, (b) curricular structure, and (c) pedagogical method. The physical space of the studio afforded fluidity of people and ideas through the space, allowed both focused work and dialogue with others, and supported a feeling of community among students and faculty. The structure of the studio course afforded learning how to manage time and process, scaffolded learning, and the transfer of learning to deepen students' understanding in a way that mimicked authentic practice. The pedagogical affordances of the studio afforded reciprocal 'showing and telling' dialogue between students and their instructors and peers, allowed students to perform the dialogue of the profession, and allowed for responsive teaching to transmit basic facts and skills while encouraging the creative use of knowledge.

Research Question 2: In what ways do characteristics of studio culture intersect with the affordances of Architectural Design 1 in how students make meaning of their architectural learning and development as architectural professionals?

The second research question sought to investigate the ways characteristics of studio culture intersect with the affordances of the studio identified in RQ1 in how students made meaning of their learning and development as architectural professionals. The studio as a learning environment has a long history in architectural education, and as such, has developed a distinct set of social normalities and regularities, or a studio "culture". Studio culture, while not explicitly defined in the literature, has been characterized both positively and negatively as, for example, a sense of community (AIAS, 2002), casual and social (Samsuddin, 2008), centralizing feedback (Anthony, 2012; Cross, 2006, Collins, 2006), reflection-in-action (Schon, 1983), untimetabled design activity (Larson & Dorst, 2009), a visual and material character (Vyas, van der Veer, & Nijolt, 2013), personal sacrifice (AIAS), poor work-life balance (Anthony), and punishing critiques (AIAS; Anthony; Blair, 2006). I argue that characteristics of studio culture intersect with the affordances of the studio environment, either leveraging or weakening the value of the affordance. Using Geertz's (1973) "thick description" and study of culture, I examined how studio culture, as defined by the literature and experienced by the participants in this study, intersected with the affordances of the architecture studio in how students made meaning of learning experiences in one architecture studio course.

A community of learners and architects

An important finding in this study was that students overwhelmingly referred to the studio environment as a community of architects and learners, and expressed this feeling of community in the studio as early as the second week of the AD 1 course. Lave and Wenger's (1991) concept of communities of practice (CoP) may be applicable to the AD 1

environment. Wenger (1998) states the dimensions of practice for coherence in a community are (a) mutual engagement, (b) a joint enterprise, and (c) a shared repertoire. Certain structural and pedagogical affordances of the studio environment, and aspects of studio culture, supported this coherence in community. The students in AD 1 were mutually engaged in a rigorous design project together from the second day of the course; although they took individual approaches to the design "problems" outlined in the brief, students supported each other to find solutions to the problems (Lawson & Dorst, 2009). Students also took the other courses in the architecture curriculum together in a cohort model, further extending mutual engagement and joint enterprise across the curriculum. The social, casual student culture of the studio created conditions where it was allowed for students to talk and interact while they worked, and students regularly helped each other through sharing ideas, skills, and materials. The perception that studio is a fun place to learn helps students stay motivated to keep working. Informal relationships with their instructors, formed through frequent feedback and critique, led students to feel that they were equal partners in learning in the studio environment. Situated perspectives on learning emphasize both the socially distributed nature of knowledge and processes of identity formation; students not only acquire knowledge and skills but become a learner in a particular professional community in and through activities of that community (Lave & Wenger, 1991).

The physical affordances of the studio, however, are particularly instrumental in affording social interaction that led to coherence in a community of learners and are perhaps unique to a studio learning environment. Co-location in the studio means students have far more contact with each other than they do their instructors, and exchange ideas extensively with their peers, capitalizing on the social aspect of studio learning established in the

Bauhaus tradition and still in place today (Anthony, 2012; Lawson & Dorst, 2009). Such learning would be far less effective, or even non-existent, without being physically located nearby. Importantly, students in this study said that having a dedicated desk space at the college made them feel like they belonged to the architecture department, and that the College cares about their work. Given that the Bauhaus' "studio pedagogy" is the foundation of studio culture and design, continuing the tradition of co-location helps socialize a new culture into the discipline.

However, Wenger (1998) also stated that community doesn't imply that the interactions between members will always be harmonious, collaborative, or egalitarian. Much has been written about the hidden curriculum (Dutton, 1991) of studio learning, drawing attention to asymmetrical power relations between students and faculty, and pedagogical practices that sustain division of social class and privileges certain social identities. Morton (2012) stated that it is the inherent power differential found in the main pedagogical element of the studio – the critique – that constrains students' opportunities for legitimate participation. Certainly, there are structures of power and privilege both within education academy and within the architectural profession that overlap in the studio environment (Gray, 2013; Webster, 2006). However, I found that students felt their interactions in the studio environment were useful and important in becoming a part of the architectural community, which also corresponds with previous findings (Morton, 2012; Webster, 2016). It should also be noted that studio's open, communal culture privileges students who thrive in more social learning environments, and tacitly communicates that being social is a key attribute of successful architects. Instructors should be cognizant of

providing a range of ways "participation" in learning the studio environment is demonstrated to create a more equitable approach for all learners (Monahan, 2013).

Centralizing feedback

Social interaction in the studio centers around feedback through one-on-one communication between the students and their instructors, peer-to-peer interactions, and interactions with visiting critics. Critiques in all their forms offered pedagogical affordances for feedback in AD 1. Visiting critics' feedback, although perceived as "harsh", was useful to students; "outside" critics provide more formal feedback than students' instructors, especially later in the term once the relationship between the instructors and students becomes more informal, and this formality motivates students to work harder. This "harsh" or "honest" feedback also communicates to students that separating themselves from their work is a value of design practice (Sawyer, 2012). However, the peer-to-peer feedback found in the informal, daily social interactions between students was cited to be just as impactful for students' learning. For example, students referenced their peers almost as often as they referenced Natalie, and much more than other AD 1 instructors or visiting critics, when asked about sources of effective feedback. These findings reiterate Dannels et al (2011) who posited that feedback in educational spaces is largely relational. For example, students in AD 1 perceived feedback from visiting critics as "direct" and "honest" but feedback from their peers was seen as "helpful" and "important", which may imply that students interpret the value of feedback through the lens of their perceived relationship between themselves and their critic. Since students in AD 1 felt that accepting and analyzing feedback was seen as critical to learning and success as an architecture student, further

attention should be paid to the complex relational systems though which feedback is given and received in the studio environment.

This study also revealed that students listening in on peers' feedback from instructors afforded learning how others' wrestle with problems and create solutions which would help them be successful with their own tasks. The open layout, co-location, and shared projects across all AD 1 studios afforded participation through listening-in. I also found that the way Natalie structured her pin-ups and group crits, through her explicit modeling of the act of providing feedback and coaching students as they critiqued their peers' work, also afforded learning of effective feedback dialogue. Rogoff, Paradise, Arauz, Correa-Chávez, and Angelillo (2003) noted that this listening in is a form of *intent participation* which allows for students to learn through observing the flow of an activity. Natalie first modeled dialogue, then guided her students when they took over critiquing their peers. In the group crit, the students and their instructor became partners in solving the presenting students' design problems. Listening in on others' feedback not only allowed students to understand design concepts and skills through a vicarious learning experience, but their participation in the process helped them to develop their identity as architects and the language and practices of architecture design (Cennamo & Brandt, 2012).

Untimetabled activity

The main use of the studio in many design disciplines is the large blocks of curricular time for untimetabled design activity (Lawson & Dorst, 2009). The dedicated workspace and long hours of curricular time are intimately connected in supporting design activity in the studio environment and communicated design understandings. Students in AD 1 were able

to come and go from studio as they liked, and continue their work uninterrupted from morning to the evening. Time and space are two of the means through which learning takes place in any environment (Lave 1993; Shaffer, 2003). Time and space were so interconnected in AD 1 that students experienced a blurred boundary of "class" and personal time, making little distinction between time spent in and out of class. These physical and structural affordances of the studio were mutually enabling or reinforcing a fluid organization of time, space, and activity and helped the AD 1 studio function (Shaffer).

A culture of untimetabled activity also supported the epistemic understanding that design is a process that evolves over time (Shaffer, 2003). Larson and Dorst (2009) argued that design is an activity that cannot be scheduled, nor can it be predicted how long any one phase of the design process will take. In AD 1, an emphasis on process work also communicated to students that time is necessary to generate and reflect on how design evolves. Likewise, the affordances of the desk as a personal exhibition space afforded students the ability to personally reference how their design change over time. Students in AD 1 also equated time with dedication to architecture, acknowledging that being a successful architecture student means being present in studio to work on and refine their designs.

The untimetabled activity in the studio intersects with the affordances of mini-lectures and demonstrations scheduled on an "ad-hoc" basis. Specific technical and analytical skills were taught through these lectures and demonstrations, and often scheduled opportunistically when Natalie noticed her students wrestling with a question or problem in the course of their project work. For example, Natalie asked Instructor E to come to her studio to give a short lecture on site and program analysis when she noticed students'

struggling with the early stages of Project 3 –like all of the lectures and demonstrations in AD 1 – this activity was not outlined in the course syllabus. Such responsive teaching requires a high-degree of pedagogical content knowledge and sensitivity, intuitively knowing when to step in to provide explicit instruction (Sawyer, 2012; Shulman, 1986).

The culture of untimetabled design activity also perpetuated a notion that "putting in the time" is equated to being dedicated to architecture. Untimetabled design activity also transmits the notion that design work is never truly "done", and that students need to be comfortable with this idea as well as not knowing if their solution was "right". However, some students in AD 1 also felt pressured to be in studio for fear of being perceived as not dedicated to architecture. The pressure to spend long hours in the studio is seen as a major contributor to the relatively high dropout rates in architecture programs (Lawson & Dorst, 2009). Students' long hours in the studio are also at the sacrifice of developing relationships with peers outside architecture and further isolates architecture students from the wider campus community (AIAS, 2002). Architecture faculty need to be cognizant of perpetuating habits and perceptions of professional life that equates dedication to the profession with unrealistic demands on time and energy. As one architectural professional stated, "…if we want [architecture] professionals to lead healthy, balanced lives, we should not expect them to put off practicing that mindset until later in life" (AIAS, 2002, p. 7). However, the literature revealed that unsustainable work practices are introduced in architecture schools and later perpetuated in practice. If architecture school is supposed to model professional practice, the professional field must take the lead in supporting, modeling, and promoting healthy, balanced lifestyles for its employees for architecture schools to follow.

Experimentation and risk-taking

Finally, a culture of experimentation and risk-taking in the studio environment also intersected with the physical, structural, and pedagogical affordances of the studio to transmit epistemic understandings of design knowledge and practice. The studio environment is designed to help students express their developing understandings through the iterative process of design. Pedagogical affordances of regular desk crits, structural affordances of long hours and ongoing, complex projects, and physical affordances of dedicated desk space and working in proximity were all aligned and orchestrated to support a culture of experimentation and interaction with the materials of designing. Shreve et al. (2010) recognized the epistemological role of experimenting with material artifacts in the studio, observing that learning practices in the studio focused on engaging with materials in a "process of discovery" (p. 12) with unknown outcomes. Natalie explained why she encouraged her students to draw and make models by hand, "…slowing down" the thinking process. DiSessa (2004) demonstrated the ways drawing builds metarepresenational competence, or the understanding of relationship between a concept and its external representation, that marks deep engagement with complex content. In design and in the studio, making is thinking (Sawyer, 2012).

There is an interesting dichotomy in the studio environment between the openness of experimentation in the studio and highly structured and constrained projects. In AD 1, I found that the constraints in the project brief served as a catalyst for students' design ideas and progress; in their reflective practice, students in AD 1 were checking their design "moves" against the constraints of the brief. Sawyer (2012) mentioned that learning sciences research has shown that the most effective learning environments are highly constrained, yet

provide students with the opportunity to engage in authentic, situated inquiry practices. Likewise, Cennamo and Brandt (2012b) found that more focused, structured assignments allowed for greater opportunities for meta-discussions about key ideas in design. These findings suggest that learning and creativity is more greatly leveraged when projects, assignments, and tasks are highly structured and constrained rather than open-ended and less-structured.

I also found tensions present in the studio environment between competing studio cultures of community, experimentation, and an educational culture of assessment and grading. The projects in AD 1 were used as shared activity for learning and as a product for grading. However, a culture of experimentation in the AD 1 studio prioritized individuality and students admired unique work. Thus, the student had to balance experimentation and risk-taking with performing for a good grade. Both Gray (2014) and Cennamo and Brandt (2011) have explored the intersection between the professional community and the academic community of the studio environment to address the tensions between the norms and values of the two cultures and how they communicate epistemic understandings of design. They concluded that the studio serves as a bridge between professional and academic worlds, where the values of both a community of practice (in the case of AD 1, architecture) and an educational community should be acknowledged and respected. In beginning architecture studio courses where students are being introduced to both cultures simultaneously, recognizing where both these communities intersect to support or constrain learning is especially important.

Summary

Over the last 20 years, efforts have been made to combine the transmission of facts and skills in the lecture and the applied learning of the laboratory into a single learning environment, resulting in many institutions adopting a "studio approach" to learning that blends both of these cultural models (Beichner, 2014). However, Sawyer (2012) stated that the studio as a learning environment is more closely aligned with the findings of recent learning sciences research than either instructionism or apprenticeship, and constitutes a third cultural model of teaching and learning. Studio learning environments are designed to "…resolve a fundamental paradox of constructivist teaching" (Sawyer, p. 38): how to ensure that learners master core facts and skills while learning how to use knowledge creatively.

This study has demonstrated the ways in which the studio environment affords social interactions that shape students' understandings and behaviors as they learn the fundamental elements of design and architectural practice. The physical affordances of the studio environment included an open layout, public/private workspaces, and co-working in proximity to others. The structural affordances were long blocks of unscheduled work time, alignment between AD 1 and the other courses in the curriculum, and the project brief, and the sequencing of the projects, tasks, and deadlines. The pedagogical affordances include formal and informal critique, mini-lectures, and demonstrations.

The studio environment emerged over historical time in a community of practice and as such, has a distinct culture. In this study, four characteristics of studio culture as defined by the literature—(a) a community of learners and architects, (b) centralizing feedback, (c) untimetabled design activity, and (d) experimentation and risk-taking—intersected with the physical, structural, and physical affordances of the studio to support epistemological

understandings of architecture practice and learning. Students referred to the studio environment as a community of architects and learners, and expressed this feeling of community in the studio as early as the second week of the AD 1 course. Social interaction in the studio centered around feedback through one-on-one communication between the students and their instructors, peer-to-peer interactions, and interactions with visiting critics, which helped students develop their identity as architects and the language and practices of architecture. Physical and structural affordances of the studio were intimately connected in supporting untimetabled design activity in the studio environment, and communicated an epistemic understanding that design is a process that evolves over time. The experimental, risk-taking culture of the studio transmits the understanding that design is a process of exploring different possibilities for solutions to problems through the act of making.

This study examined only a small segment of a students' education in learning to become a designer, and the process to becoming an architect extends well beyond students' formal education. Students in their first years of college and university undergo tremendous amount of cognitive development and change. The intent of this research was to richly describe how physical space, structure, pedagogy, and culture interact in a complex ecology of the studio environment to shape students' emerging understanding of the knowledge and practices of their discipline.

Implications for Practice

I offer the following implications for programs of architecture and those interested in adopting studio-based learning environments based on the findings, analysis, and conclusions of this study. Given there are multiple factors that contribute to students' learning and

understanding and these factors vary across educational contexts, the implications should be assessed for their appropriateness on an individual basis.

Architecture education

The following sections provide implications for architectural education based on the findings of this study:

1. Communicate the physical affordances of studio: As illustrated in the findings, the private-public nature of students' work space and students' co-location in the studio is important in the development of design ideas and the progression of design learning (Lawson & Dorst, 2009). The ability for students to work at dedicated desk spaces affords faculty to witness students' individual process, for peers to see how others solve design problems, and students to individually reference changes in their designs and their learning over time. The open layout affords novice faculty to witness how other faculty are teaching, to borrow techniques that "work" to advance their own pedagogy. The finding that students equated a dedicated desk with a sense of belonging cannot be understated. As colleges face pressure to increase enrollments and assignable square footage to classroom spaces, senior management may question the need to devote large amounts of valuable campus real estate to architecture studios. Further research may demonstrate the effect dedicated desk space has on student retention in architecture programs. Communicating the affordances of dedicated desk space, open, spacious studio layouts, and co-locating students helps to justify the use of these physical resources to support students' learning (Lawson & Dorst).

2. Horizontally align, but allow for "breaks" in the alignment: The horizontal alignment of studio with other courses in the curriculum afforded students the ability to conditionalize their knowledge from various sources, to recognize gaps in their knowledge, and allowed for students to feel what they were learning across the curriculum was relevant to their development as architects. Engaging in curriculum mapping (Allen, 2004; Suskie, 2010) where content and skills are identified in coursework and projects at each level of the curriculum, can reveal gaps and repetition, as well as opportunities for integration and revisiting content. However, students also appreciated when there was a "break" in the alignment, enabling them to focus on content unrelated to studio. While best efforts should be made to map context across the curriculum, faculty should also recognize that breaks in the alignment offer an important respite from the intensity of the architecture curriculum. The extent of this horizontal alignment across the curriculum should be balanced with instructors' need to be flexible to respond to students' needs during the development in their understanding.
3. Capitalize on the affordances of group critiques: Of all the critique interactions, the pin-up afforded the modeling of effective critique dialogue and afforded the opportunity for students to rehearse dialogue under the guidance and coaching of the instructor in a group setting. The pin up also afforded the opportunity for students to witness how their peers wrestle with design problems; a demonstration in reflection and action using a peer as an illustrative case. In these ways, the pin up serves as an important learning and enculturation mechanism for novice architecture students. Although the individual desk crit is the cornerstone of architectural pedagogy,

individual instruction is time consuming. More emphasis on the group crit or pin up, and less emphasis on individual desk crits, may offer students' opportunities for feedback and reflection while capitalizing on the affordances of listening in and vicarious learning experiences.

4. Give students agency by allowing them to shape their learning environments: Finally, students were aware of how the studio environment supports their learning. Affording students the opportunity to employ their knowledge in shaping their learning environment gives students agency over their learning (Kuh, Kinzie, Schuh, & Whitt, 2011). For example, giving students the opportunity to provide feedback on their physical learning space invites students to take an active role in shaping the learning environment through decision-making and joint ownership of the process and outcome.
5. Ensure students maintain a healthy school-life balance: Architecture school can be a stressful, rigorous experience for students, and poor school-life balance is a main reason for attrition in architecture programs (AIAS, 2008; Lawson & Dorst, 2009). Encourage students to maintain good physical and emotional health and resist the pressure to always be working by practicing good time management and allowing students to take regular breaks away from the studio. Ensure that your students getting adequate sleep, exercise, and eating healthy. Reassure students that maintaining personal connections with other students outside the architecture department and engage in campus activities makes them well-rounded individuals. Most importantly, promote healthy work-life balance by modeling this behavior for your students.

Adopting the affordances of studio in non-studio environments

Although this study focused on the studio environment, the research has implications for those teaching in non-studio environments. The following topics are offered for faculty interested in adopting the affordances of studio learning environments to non-studio environments or non-design disciplines:

1. Mimic the affordances of the public/private nature of studio environments: First, instructors interested in adopting studio environments should look to the affordances of the public-private nature of students' workspace. As noted, the public-private nature of the studio environment was important in helping students develop ideas and progress in their learning. Affordances of the studio environment allow space for personal, focused work, yet capitalize on co-location by allowing students collaborate by engaging in dialogue and sharing their work with their peers for feedback. Allowing students to control the public/private nature domain of their work is an important element of the studio environment (Lawson & Dorst, 2009). For example, virtual learning environments may afford both private, asynchronous, personal work space as well as synchronous, public, sharing dialogue space. A "virtual studio" may include private online work space, a chat room or discussion forum for the verbal exchange of ideas, a posting area or semi-public space for students to test ideas and works in progress for informal feedback, and a space for posting final work for public review, critique, and assessment. Ethnographic studies of virtual "studios" may provide additional insights into the unique affordances of these environments (Boellstorff, Nardi, Pearce & Taylor, 2012; Maher, Simhoff, & Cicognani, 2006).
2. Reconsider public/private work processes and assessment**:** A shift to adopting the

public/private nature of studio learning also requires a reconsideration of the nature of how students produce their work and the assessment of their learning (Loewenthal & Thomas, 2010). In the reconsideration of allowing assessment to be made public, instructors should aim to both centralize feedback in their courses and allow students to listen-in to their peers' feedback. Research has shown the benefits from regular, timely feedback (Nathan & Sawyer, 2006), and feedback is critical to the learning process (Krajeck & Shin, 2006). Studio instruction devotes a large amount of time to engaging learners in discussions around work-in-progress and providing suggestions for improvement. Acknowledging the affordances for learning regular critique provides, researchers have explored the ways the feedback practices of the studio can be translated to non-design disciplines. Schrand and Eliason (2012) suggested that liberal arts courses should devote more time for in-class writing and peer review to capitalize on the "shared experiences, stronger social bonds, and effective pedagogical interventions" (p. 60) of the studio environment. Coursework that relies on various forms of media (video, interactive environments, music, etc.) as both communication and learning tools can utilize critique as an authentic way to assess the alignment between students' intentions and the representation of ideas in students' work (Sheridan, Halverson, Litts, Brahms, Jacobs-Priebe, & Owens, 2014). Likewise, students in AD 1 mentioned how listening in to their peers' reviews and critiques afforded a vicarious learning experience. Rogoff et al. (2003) have demonstrated the ways people learn through observing and listening in as they participate in shared, authentic practices. Listing in also has the added affordance of encouraging identity formation through role playing. Students' participation in their

peers' critiques allows students to explore their identities by placing themselves in the roles of observer, critic, and author and take on roles they may not be able to experience in real life (Gadsden, 2008; Sheridan et al, 2014).

3. Allow students to demonstrate their emerging understandings visually: Constructionism posits that learners create their own knowledge by building physical artifacts, which in turn lead to the construction of conceptual representations (Nathan & Saywer, 2006). Making physical artifacts makes visible students' emerging understandings and misconceptions, opening up the possibly for formative feedback (Kafai, 2006). The findings in this study illustrated the many ways the studio allowed for students' and instructors' thinking to be made visible to others. The generation of successive, visual representations demonstrating students' growing conceptual understanding has been shown to be effective in mathematics and science learning, and building students' metarepresentational competence, or how to construct and use external representations, is critical to scientific literacy (diSessa, 2004). Allowing students to demonstrate their emerging understandings visually not only builds students' metarepresentational competence, but allows instructors to see how students' conceptions are developing over time in order to adapt instruction to meet their changing educational needs.
4. Guide and constrain constructivist learning environments: Finally, studio learning is parallel to project-based learning, a form of situated learning where students gain deeper understanding through working with and using ideas in authentic contexts (Krajcik & Blumenfeld, 2006; Lave & Wenger, 1991). The findings in this study showed the project brief was an important framing device in students thinking and an

assessment tool for students to judge the quality of their design decisions. In particular, the project constraints within the brief afforded students' greater creativity through both limiting students' options and providing benchmarks or guidelines as they worked through the solution to a problem. Creativity research has shown that certain types of constraints encourage idea generation (Lawson & Dorst, 2009; Sternberg & Kaufman, 2010), and in engineering education, constraints introduced late in a project allowed for more creative problem solving (Onarheim, 2011). Constraints also slow students down so they don't move to quickly to a solution. Sawyer (2012) states that learning sciences research has shown that the most effective learning environments are highly constrained while providing students with the opportunity to engage in situated, inquiry practices. Constructivist learning environments must be carefully guided and projects highly constrained by the parameters of projects assignments and the sequencing of projects over the term, to result in maximum effectiveness (Sawyer).

5. Encourage cooperation through the sharing of knowledge and expertise: Students in AD 1 regularly shared their knowledge, materials, ideas and feedback with their peers, which contributed to their sense of community in studio. Although aspects of competitiveness were present, most of the students in this study expressed a desire to see their colleagues succeed in the course. Wenger's (1998) dimensions of practice for coherence in a community—(a) mutual engagement, (b) a joint enterprise, and (c) a shared repertoire—provide a model for fostering a sense of community in the classroom. Encouraging students to share their knowledge and expertise with their peers, engage in regular dialogue around shared goals, and de-emphasizing

individualism and competition between students, especially in assessment practices, are practical steps toward fostering classroom community.

Recommendations for Future Research

I have addressed topic for further inquiry in previous sections of this chapter. Nevertheless, a few additional topics are presented as recommendations for future research in beginning architectural education and/or studio learning environments.

1. Sustained and focused examinations of the physical or structural affordances of studio environments: This study has demonstrated the affordances for learning the curricular structure and physical space in the studio environment, such as the public/private nature of the workspace, co-location, and long blocks of curricular time for design activity. Studio pedagogy, and critique in particular, has been well-researched. However, consideration should also be paid to the physical space and curricular structure of studio environments, both of which have not yet been given as much empirical attention (Sawyer, 2012).

   Likewise, a sustained study of the structure of architecture courses, especially in relation to project- or problem-based learning, could provide insight for curriculum design in other disciplines such as STEM fields (Sawyer). For example, the use of a project brief in architecture education is intended to both frame the design problem and the "driving question" in a real-world context and focus learning objectives (Krajcik & Shin, 2014). The constraints of the project brief not only mimic architectural practice, but transmit an enduring understanding that finding possibility within extremely tight site- and context-specific constraints is fundamental work to

the work of architecture. Further empirical work specifically related to context-specific constraints in case-based architecture projects could provide insights for pedagogical design of problem-based learning environments (Lu, Bridges, and Hmelo-Silver, 2014).

2. Discourse analyses of pin-ups or group critiques, especially peer-led critiques: The findings in this study illustrated the affordances of students' listening in to their peers' critiques, the modeling of critique dialogue in pin-ups, and the 'showing and telling' reciprocal dialogue of critiquing in general. A focused study on the reciprocal discourse of critique could further examine the ways language and social interactions transmit ideas about design knowledge and practice. For example, Murphy et al. (2102) explored the use of analogical reasoning as a means for problem-finding in desk critique interactions. Further research that specifically examines at how the dialogue of the pin up or group critique facilitates students' design learning is crucial given the pin-up or group critique has garnered the least empirical attention from researchers (Gray, 2013).
3. Focused examinations on the learning strategies and activities of high-achieving architecture students: Students' achievement in college is influenced by many factors including motivations, beliefs, habits, and curricular and co-curricular experiences (Robbins, Lauver, Le, Davis, Langley et al., 2004). Although outside of the bounds of this current study, a focused examination of the behaviors, motivations, and beliefs delineated by high-achieving students could provide insight into the ways these students self-regulated their learning in a studio course.
4. Sourcing the myths and folklore of studio culture: The student participants in this

study entered with pre-conceived notions of studio culture despite never having had been in a studio course in architecture. Even though definitions of studio culture are elusive in the literature (AIAS, 2008), the findings revealed that students' perceptions of studio culture intersected with their attitudes about studio and their behaviors in the studio environment. For example, in their early interviews students mentioned how final reviews had to be harsh to be good although they had yet to participate in a final review in AD 1 with external reviewers. Future studies should not only attempt to define studio culture though the lived experiences of architecture students and faculty, but also investigate where some of these pre-conceived notions and beliefs about studio culture come from. Dispelling some of the "myths" and "folklore" of studio culture may combat some of the negative aspects while leveraging the positive aspects of learning in a studio environment.

5. Investigations of architecture students' perceptions of school-life balance: Findings in this study showed that the AD 1 students experienced a blurred boundary between school time and personal time, and some felt pressure to be present in studio even when they had little work to do for fear of being "branded" as not as dedicated to architecture school. Given that the literature on architecture education equates poor-school-life balance with attrition in architecture schools (Lawson & Dorst, 2009) and isolation of architecture students from campus peers (AIAS, 2002), research should continue to explore architecture students' perceptions of school-life balance during all stages of architecture study.
6. A critical look at the intersection of social identities and learning in the studio environment: As mentioned in Chapter 4, the lack of a critical lens to view studio

culture may be considered a limitation of this research. Although I did not view this work with a critical lens, I was witness to acts of microaggressions and harassment in the AD 1 studio environment, and I also heard frequent instances of gender bias in how students discussed female professors versus male professors during my time in AD 1. Researchers should continue to devote empirical attention to the intersection of race, gender, and other social identities and learning in studio environments.

Reflection

This ethnographic case study was conducted to provide a rich description of the learning environment of a studio course to explore how interactions in the studio environment shape students' understandings and behaviors as they learn the fundamental elements of design and architectural practice. The conclusions drawn from this study help one to understand the role of the studio environment in supporting students' architectural knowledge and identity, and provide insight into how individual-environment interactions shape how students make meaning of their learning experiences.

The discussion of the findings illustrated the ways interactions in the studio environment shape students' understandings and behaviors as they learn the fundamental elements of design and architectural practice. The knowledge generated from this study will help to understand the role of the studio environment in supporting students' architectural knowledge and identity, and provide insight into how individual-environmental interactions shape how students make meaning of their learning experiences.

This chapter portrayed the learning experiences in Architecture Design 1 (AD 1), a beginning architecture course in a college of design at a large, public university. Using a

conceptual framework of affordances (Gibson, 1979; Greeno 1994), I described the various ways the studio environment creates opportunities for social interaction, and how characteristics of studio culture intersects with the affordances of the studio environment in how students make meaning of their learning.

In summary, the physical affordances of the AD 1 studio environment included an open layout, public/private workspaces, and co-working in proximity to others. The structural affordances were long blocks of unscheduled work time, alignment between AD 1 and the other courses in the curriculum, and the project brief, and the sequencing of the projects, tasks, and deadlines. The pedagogical affordances were formal and informal critique, mini-lectures, and demonstrations. Four characteristics of studio culture as defined by the literature—(a) a community of learners and architects, (b) centralizing feedback, (c) untimetabled design activity, and (d) experimentation and risk-taking— intersected with the physical, structural, and physical affordances of the studio identified in RQ1 in how students made meaning of their learning and development as architects.

The physical space of the studio afforded fluidity of people and ideas through the space, allowed for both focused work and dialogue with others, and supported a feeling of community among students and faculty. The structure of the studio course afforded learning how to manage time and process, scaffolded learning, and the transfer of learning to deepen students' understanding in a way that mimicked authentic practice. The pedagogical affordances of the studio afforded reciprocal "showing and telling" dialogue between students and their instructors and peers, enabled students to perform the dialogue of the profession, and allowed for responsive teaching to transmit basic facts and skills while encouraging the creative use of knowledge.

Students referred to the studio environment as a community of architects and learners, and expressed this feeling of community in the studio as early as the second week of the AD 1 course. Social interaction in the studio centered around feedback through one-on-one communication between the students and their instructors, peer-to-peer interactions, and interactions with visiting critics, which helped students develop their identity as architects and the language and practices of architecture. Physical and structural affordances of the studio were intimately connected in supporting untimetabled design activity in the studio environment, and communicated an epistemic understanding that design is a process that evolves over time. The experimental, risk-taking culture of the studio transmits the understanding that design is a process of exploring different possibilities for solutions to problems through the act of making.

This chapter provided an interpretation of the findings of this study in relation to the wider literature on affordances, culture, studio learning, and learning environments research. I have also offered implications of this research based on the findings for practice in architecture and those interested in adopting studio-based learning environments in non-design fields. Lastly, I have suggested topics for future research in beginning architectural education and/or studio learning environments.

Final Thoughts

During his mini-lecture on site analysis, Instructor E said, "…we build layers of experience that make us know who we are and what we know." I have come to think of these words not only as succinctly describing the experience of learning but also eloquent in explaining why I engage in qualitative research. I engaged in this research to learn more about studio learning. My experiences as a researcher/participant in AD 1 have taught me more about myself as a researcher, administrator, and educator than I ever anticipated I would learn.

This study was a collaborative effort between myself and the participants in this study—Natalie and her students in AD 1, who willingly shared their experiences of learning in the architecture studio. There was more nuance and beauty in the students' thoughts, behaviors, and interactions in the AD 1 environment than I was ever able to capture, but I hope I have been able to "focus on the verbs of life" in my description of their experiences. It was my goal that, through sharing the students' experiences of learning in AD 1, we might have a better understanding of how the studio environment shapes who they are and what they know in their journey to becoming architectural professionals.

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APPENDIX A. INSTITUTIONAL REVIEW BOARD APPROVALS

A-1. Original IRB Approval

IOWA STATE UNIVERSITY
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Date: 8/18/2015

To: Melissa Rands
E005 Lagomarcino

CC: Dr. Ann Gansemer-Topf
2621 Lagomarcino

From: Office for Responsible Research

Title: Beginning Architecture: Affordance Networks, Critique, and the Emergence of Design Knowledge

IRB ID: 15-385

Approval Date:	8/18/2015	**Date for Continuing Review:**	8/17/2017
Submission Type:	New	**Review Type:**	Expedited

The project referenced above has received approval from the Institutional Review Board (IRB) at Iowa State University according to the dates shown above. Please refer to the IRB ID number shown above in all correspondence regarding this study.

To ensure compliance with federal regulations (45 CFR 46 & 21 CFR 56), please be sure to:

- **Use only the approved study materials** in your research, **including the recruitment materials and informed consent documents that have the IRB approval stamp.**
- **Retain signed informed consent documents for 3 years after the close of the study,** when documented consent is required.
- **Obtain IRB approval prior to implementing any changes** to the study by submitting a Modification Form for Non-Exempt Research or Amendment for Personnel Changes form, as necessary.
- **Immediately inform the IRB of** (1) **all serious and/or unexpected adverse experiences** involving risks to subjects or others; and (2) **any other unanticipated problems involving risks** to subjects or others.
- **Stop all research activity if IRB approval lapses,** unless continuation is necessary to prevent harm to research participants. Research activity can resume once IRB approval is reestablished.
- **Complete a new continuing review form** at least three to four weeks prior to the **date for continuing review** as noted above to provide sufficient time for the IRB to review and approve continuation of the study. We will send a courtesy reminder as this date approaches.

Please be aware that IRB approval means that you have met the requirements of federal regulations and ISU policies governing human subjects research. **Approval from other entities may also be needed.** For example, access to data from private records (e.g. student, medical, or employment records, etc.) that are protected by FERPA, HIPAA, or other confidentiality policies requires permission from the holders of those records. Similarly, for research conducted in institutions other than ISU (e.g., schools, other colleges or universities, medical facilities, companies, etc.), investigators must obtain permission from the institution(s) as required by their policies. **IRB approval in no way implies or guarantees that permission from these other entities will be granted.**

Upon completion of the project, please submit a Project Closure Form to the Office for Responsible Research, 1138 Pearson Hall, to officially close the project.

Please don't hesitate to contact us if you have questions or concerns at 515-294-4566 or IRB@iastate.edu.

A-2. Modified IRB Approval

IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY

Institutional Review Board
Office for Responsible Research
Vice President for Research
1138 Pearson Hall
Ames, Iowa 50011-2207
515 294-4566
FAX 515 294-4267

Date: 9/24/2015

To: Melissa Rands
E005 Lagomarcino

CC: Dr. Ann Gansemer-Topf
2621 Lagomarcino

From: Office for Responsible Research

Title: Beginning Architecture: Affordance Netwroks, Critique, and the Emergence of Design Knowledge

IRB ID: 15-385

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- **Stop all research activity if IRB approval lapses**, unless continuation is necessary to prevent harm to research participants. Research activity can resume once IRB approval is reestablished.
- **Complete a new continuing review form** at least three to four weeks prior to the **date for continuing review** as noted above to provide sufficient time for the IRB to review and approve continuation of the study. We will send a courtesy reminder as this date approaches.

Please be aware that IRB approval means that you have met the requirements of federal regulations and ISU policies governing human subjects research. **Approval from other entities may also be needed.** For example, access to data from private records (e.g. student, medical, or employment records, etc.) that are protected by FERPA, HIPAA, or other confidentiality policies requires permission from the holders of those records. Similarly, for research conducted in institutions other than ISU (e.g., schools, other colleges or universities, medical facilities, companies, etc.), investigators must obtain permission from the institution(s) as required by their policies. **IRB approval in no way implies or guarantees that permission from these other entities will be granted.**

Upon completion of the project, please submit a Project Closure Form to the Office for Responsible Research, 1138 Pearson Hall, to officially close the project.

Please don't hesitate to contact us if you have questions or concerns at 515-294-4566 or IRB@iastate.edu.

APPENDIX B. RECRUIMENT SCRIPT AND INFORMED CONSENT

B-1. Recruitment Script

(First recruitment visit: Introduction to the study)

Hello!

My name is Melissa Rands, and I am a doctoral candidate in the School of Education at Iowa State University (ISU). I am conducting a study to understand how the studio environment supports or constrains students' understanding of design knowledge and practice. This study was approved by ISU's Institutional Review Board (IRB), # 15-385.

Since this project is about how students learn, it is extremely important to collect information from students who are learning in a studio environment like this class. I'm here today to ask you to be a participant in this research. In order to participate in this study, you must identify as:

1) Undergraduate, bachelor degree-seeking student majoring in Architecture;
2) Enrolled in this course for the first time; and
3) Over the age of 18 (no minors are allowed to participate in this study).

The classroom/studio context is important to the study, so all of you enrolled in ARCH 201 are eligible to participate.

Participation will take place in two ways:

1. **Interviews.** Participation will take place in a series of three interviews, each lasting no more than one hour, over the course of the fall 2015 semester. I will lead all interviews, and they will take place in a mutually agreed-upon location and time. The interviews will involve me asking you questions about your design background, your work, and the in-studio resources you draw upon to aid your design thinking, and how you utilize feedback from your instructors, critics, and peers. The interviews will be recorded and transcribed.

   During the interviews, I will be asking you questions about your design work in this course. I recognize that thinking in design is characteristically done with visual representation and communication intertwined. Therefore I will ask you to show your design work to me as you discuss your thinking – but this is completely voluntary. If you choose to do so, you can show me your work in studio or outside of studio, through your computer, physical models, or photographs. I will be taking notes about your design work only as it relates to the discussion; no photographs will be taken, nor will any of your design work be collected for this study.

2. **Observations.** I will also observe three of your in-class critiques during the semester: a pin up, your mid-term critique, and your final review. These observations will involve me taking notes of how you describe the affordances you drew upon to aid your design thinking, the process of the critique interaction, the types of feedback you receive, and how design knowledge is communicated by your critic. Only my written notes will describe the critiques; no audio or video will be used during the critique sessions.

Do you have any questions about what "participation" means in this study? *(Wait for questions).*

Participation in this study is completely voluntary and your name will not be attached to the project. If you agree to participate I will assign you a pseudonym that we'll use throughout the project. Additionally, even if you agree to participate today you may choose to leave the study at any time.

I need to also address any risks you may encounter as a participant in this study. Although there are minimal risks to you personally, you may encounter emotional discomfort from answering questions about your experiences during critique, especially if you feel you had a negative experience or you perceive your performance in this class, including the critiques, was inadequate or poor. You may choose to skip questions in the interviews that make you feel uncomfortable, or you may stop the interviews at any time. You may also ask me to omit certain information about your observed critique session or omit your observation session entirely. You will also have a chance to personally review the transcripts of the interviews and observation notes used in this study before any analysis takes place.

Do you have any questions? *(Wait for response; answer questions).*

Thank you for listening today and your consideration of participation in this research. If you have any questions or concerns about what I've proposed, please email or phone me. My cell phone number is on the back of the card. Please know I'll keep your questions or concerns confidential. I'll be back at the next class session to answer any further questions and ask for your participation.

(Second recruitment visit: Additional questions and informed consent)

Hi everyone!

As you recall, I was here two days ago discussing a research study I am conducting. As you've had a chance to think about it, do you have any questions? *(Wait for response; answer questions, repeat introductory script if necessary)*

OK, here is a form called an "informed consent document". It outlines everything I discussed two days ago about the research, including the risks and benefits of participation. Please take a moment to read it through. *(Wait.)*

Do you have any questions about the informed consent document?

If you agree to participate in the study, please sign and date the form and provide your email address – I will be communicating with you by email throughout the project. If you do not want to participate, just mark "I do not wish to participate" where your signature is on the form. You'll notice I asked your professor to leave the room. I asked her to do that so she doesn't know who has agreed to participate in the research and who hasn't.

B-2. Student Informed Consent Document

Beginning Architecture: Affordance Networks, Critique, and the Emergence of Design Knowledge

Investigators: Melissa L. Rands, School of Education, Iowa State University
Dr. Ann Gansemer-Topf, School of Education, Iowa State University

This form describes a research project. It has information to help you decide whether or not you wish to participate. Research studies include only people who choose to take part—your participation is completely voluntary. Please discuss any questions you have about the study or about this form with the project staff before deciding to participate.

Introduction
The purpose of this case study is to explore how beginning architectural students' design knowledge emerges over the course of one academic semester. The aim of the study focuses specifically on how beginning architects speak about they access the resources they need to be successful in their design work, and how their perceptions of these resources change as a result of in-class critiques. It is anticipated the knowledge generated from this study will help understand the role of the environment in motivating beginning architects, and provide insight into how feedback alters students' meanings with respect to the content being taught.

You are being invited to participate in this study because you have identified as (1) an undergraduate, bachelor degree-seeking student majoring in Architecture; (2) you are enrolled in architecture for the first time; and (3) you are over the age of 18. You are invited to take part in the study because you are currently enrolled in ARCH 201 in fall 2015.

Description of Procedures
If you agree to participate in the study, you will be asked to participate in two ways:

1. **Interviews.** Participation will take place in a series of four interviews, each lasting no more than one hour, over the course of the fall 2015 semester. I will lead all interviews, and they will take place in a mutually agreed-upon location and time. The interviews will involve me asking you questions about your design background, your work, the resources you draw upon to aid your design thinking, and how you utilize feedback from your instructors and peers. The interviews will be recorded and transcribed.

   During the interviews, I will be asking you questions about your design work in this course. I recognize that thinking in design is characteristically done with visual representation and communication intertwined, therefore I will ask you to show your design work to me as you discuss your thinking. This can be done in studio or outside of studio, through your computer, physical models, or photographs. I will be taking notes about your design work only as it relates to the discussion; no photographs will be taken, nor will any of your design work be collected for this study.
2. **Observations.** I will also observe your social interactions in the studio environment, including your in-class critiques, over the course of the fall 2015 semester. These observations will involve me taking notes of your interactions with the physical studio space, your classmates, the instructor in this course, and with visiting professors and/or critics. Only my written notes will describe the observations; no audio or video recordings will be collected.

I understand that participation in this study includes multiple interviews and observations of my social interactions in the studio, including critiques, over course of the academic semester.
_____(initial here)

As this study looks at how students' perceptions change over the course of one academic semester, you will be asked to participate from August 2015 to January 2016. However, you may choose to leave the study at any time.

Risks or Discomforts
There are minimal risks to you personally by participating in this study. You may encounter emotional discomfort from answering questions about your experiences during critique, especially if you feel you had a negative experience or you perceive your performance in the critique was inadequate or poor. You may choose to skip questions in the interview that make you feel uncomfortable, or you may stop the interview at any time. You may also ask me to omit certain information about your observed critique session or omit your observation session entirely. At each interview, we will reserve time to discuss the previous interviews and observations and to clarify any misinterpretations. You will have the option to read and edit your interviews and observation documents after data collection is completed. These documents will be emailed to you and you will have one week to review the documents and make changes.

You may also feel there are risks to your academic performance in this course due to your participation (or non-participation) in this study. I will take various steps to protect your confidentiality as a participant or non-participant. For instance, I will be present during the critiques of the participants and taking notes; I will also be present during the critiques of non-participants and writing, but not taking any notes or collecting any data. That way, my presence in the critiques should not disclose your participation to others. Also, I have no control over your grades in the course, and I do not work for the College of Design in any capacity. The instructor in this course has provided documentation stating that students will not be penalized, academically or otherwise, if they choose not to participate.

Benefits
Participating in this study does not cost you anything, and there will not be any compensation to you directly for your participation. It is hoped that the information gained in this study will benefit higher education generally, and architecture education specifically, by providing information to educators on the role of critique in motivating beginning architects and how interactions with the social environment alter students' perceptions of design knowledge.

Participant Rights
Participating in this study is completely voluntary. You may choose not to take part in the study or to stop participating at any time, for any reason, without penalty or negative consequences. You may be concerned that your participation in this research will affect you academically. I am not a faculty member in this course, nor am I a faculty member in the Architecture department or the College of Design, therefore I have no control over your grades or any other assessment of your performance. The instructor for this course or any other administrator in the College will have no access to the data at any time. Your choice to participate or not participate in this study will have no impact on you as a student in any way.

Confidentiality
Records identifying participants will be kept confidential to the extent permitted by applicable laws and regulations and will not be made publicly available. However, federal government regulatory agencies**,** auditing departments of Iowa State University, and the Institutional Review Board (a committee that reviews and approves human subject research studies) may inspect and/or copy study records for quality assurance and data analysis. These records may contain private information.

To ensure confidentiality to the extent permitted by law, the following measures will be taken: I will remove any identifying information from the data. When the results are published, I will not use your

real name, the name of your course or college, or the name of your current university. I will use pseudonyms instead. All of the data from this study will be kept in a locked file cabinet at my home only I have access to, as well as in a password-protected file in CyBox.

Please note that while I will take measures to protect your identity as a participant in this study, it is possible that someone may be able to determine your identity through a description of the study context.

Questions or Problems
You are encouraged to ask questions at any time during this study. For further information about the study, contact Melissa Rands at mrands@iastate.edu or Dr. Ann Gansemer-Topf (515-294-7635), anngt@iastate.edu. If you have any questions about the rights of research subjects or research-related injury, please contact the IRB Administrator (515-294-4566), IRB@iastate.edu, or Director (515-294-3115), Office for Responsible Research, Iowa State University, Ames, Iowa 50011.

Consent and Authorization Provisions
Please indicate whether or not you voluntarily agree to participate in this study. If you indicate your intention to participate, you also agree that the study has been explained to you, that you have been given the time to read the document, and that your questions have been satisfactorily answered. If you choose to participate, you will receive a copy the completed informed consent form prior to your participation in the study.

I agree to participate in the study

Participant's Name (printed): _____

Participant Signature: _____ Date: _____

Participant's Email Address: _____

Participant's Phone Number: _____

_____ **I do not wish to participate in the study**

Principal Investigator's Signature:_____ Date: _____

B-3. Faculty Informed Consent Document

Beginning Architecture: Affordance Networks, Critique, and the Emergence of Design Knowledge

Investigators: Melissa L. Rands, School of Education, Iowa State University
Dr. Ann Gansemer-Topf, School of Education, Iowa State University

This document describes a research project. It has information to help you decide whether or not you wish to participate. Research studies include only people who choose to take part—your participation is completely voluntary. Please discuss any questions you have about the study or about this form with the project staff before deciding to participate.

Introduction

The purpose of this case study is to explore how beginning architectural students' design knowledge emerges over the course of one academic semester. The aim of the study focuses specifically on how beginning architects speak about they access the resources they need to be successful in their design work, and how their perceptions of these resources change as a result of in-class critiques. It is anticipated the knowledge generated from this study will help understand the role of the environment in motivating beginning architects, and provide insight into how feedback alters students' meanings with respect to the content being taught.

You are being invited to participate in this study because you 1) are the instructor of ARCH 201 in fall 2015 and 2) you are over the age of 18.

Description of Procedures

If you agree to participate in the study, you will be asked to participate in two ways:

1. **Interviews.** If you agree to participate in the study, you will be asked to participate through a series of four interviews, each lasting no more than one hour, over the course of the fall 2015 semester. I will lead all interviews, and they will take place in a mutually agreed-upon location and time. The interviews will involve me asking you questions about 1) your goals for the course, 2) your thoughts and beliefs about studio pedagogy, and 3) your perceptions of students' progress in the course. The interviews will be recorded and transcribed.

2. **Observations.** I will also observe your social interactions with students in the studio environment, including desk critiques, over the course of the fall 2015 semester. These observations will involve me taking notes of desk critiques with the student participants as well as more informal interactions between yourself and your students as part of the regular studio pedagogy and culture of the studio environment. Only my written notes will describe the observations; no audio or video recordings will be collected.

I understand that participation in this study includes multiple interviews and observations of my social interactions in the studio, including critiques, over course of the academic semester.
_____(initial here)

You will be asked to participate from September 2015 to January 2016. However, you may choose to leave the study at any time.

Risks or Discomforts

There are minimal risks to you personally by participating in this study. You may choose to skip questions in the interview that make you feel uncomfortable, or you may stop the interview at any time. You may also ask me to omit certain information from the interview or omit your interview entirely. At each interview, we will reserve time to discuss the previous interviews and observations and to clarify any misinterpretations. You will have the option to read and edit your interviews after data collection is completed. These documents will be emailed to you and you will have one week to review the documents and make changes.

Benefits

Participating in this study does not cost you anything, and there will not be any compensation to you directly for your participation. It is hoped that the information gained in this study will benefit higher education generally, and architecture education specifically, by providing information to educators on the role of critique in motivating beginning architects and how interactions with the social environment alter students' perceptions of design knowledge.

Participant Rights

Participating in this study is completely voluntary. You may choose not to take part in the study or to stop participating at any time, for any reason, without penalty or negative consequences. I am not a faculty member in this course, nor am I a faculty member in the Architecture department or the College of Design, therefore I have no control over assessment of your performance.

Confidentiality

Records identifying participants will be kept confidential to the extent permitted by applicable laws and regulations and will not be made publicly available. However, federal government regulatory agencies**,** auditing departments of Iowa State University, and the Institutional Review Board (a committee that reviews and approves human subject research studies) may inspect and/or copy study records for quality assurance and data analysis. These records may contain private information.

To ensure confidentiality to the extent permitted by law, the following measures will be taken: I will remove any identifying information from the data. When the results are published, I will not use your real name, the name of your course or college, or the name of your current university. I will use pseudonyms instead. All of the data from this study will be kept in a locked file cabinet at my home only I have access to, as well as in a password-protected file in CyBox.

Please note that while I will take measures to protect your identity as a participant in this study, it is possible that someone may be able to determine your identity through a description of the study context.

Questions or Problems

You are encouraged to ask questions at any time during this study. For further information about the study, contact Melissa Rands at mrands@iastate.edu or Dr. Ann Gansemer-Topf (515-294-7635),

anngt@iastate.edu. If you have any questions about the rights of research subjects or research-related injury, please contact the IRB Administrator (515-294-4566), IRB@iastate.edu, or Director (515-294-3115), Office for Responsible Research, Iowa State University, Ames, Iowa 50011.

Consent and Authorization Provisions

Please indicate whether or not you voluntarily agree to participate in this study. If you indicate your intention to participate, you also agree that the study has been explained to you, that you have been given the time to read the document, and that your questions have been satisfactorily answered. If you choose to participate, you will receive a copy the completed informed consent form prior to your participation in the study.

_____ **I agree to participate in the study**

Participant's Name (printed): _____

Participant Signature: _____ Date: _____

Participant's Email Address: _____

Participant's Phone Number: _____

_____ **I do not wish to participate in the study**

Principal Investigator's Signature: _____ Date: _____

APPENDIX C. INTERVIEW AND OBSERVATION PROTOCOLS

C-1. Student Interview Protocols

Interview #1

The first interview is also the first official meeting between the researcher and the participant. The purpose of this interview is to return the completed informed consent form, to gain trust and establish a relationship between the participant and the researcher, and gain baseline information about their perceptions of design knowledge and practice. Conversation will focus on learning more about their design background and their initial design thinking and approaches as they start the course. Particular attention will be paid to how students speak about the networks of affordances students perceive and take advantage of to reach their design goals.

Students will be asked to display or reference their design work during the interview. This can be done in studio or outside of studio, through computer renderings, physical models, or photographs. Field notes will be taken describing students' design work only as it relates to the discussion.

Questions:

- Tell me a little bit about yourself and about your background, where you went to school, any design or classes you had in high school before enrolling in college.
  - Prompt for student to share their demographic information (gender, age, ethnicity/race, nationality) if they feel comfortable sharing.
- How do you feel these experiences or identities shape your thinking about design? Or shaped your thinking before you enrolled in college?
- Tell me a bit about your learning experiences in Core. What did these activities teach you about being a successful designer?
- What are your goals for this course? For your studies? Why are those goals important to you?

Prompts:

Prompt students to elicit explanation of their design thinking, paying particular attention to how they access the resources they need to be successful in design. How do they describe "what's worked" in their previous design experiences and why? Are there any resources they've identified that are NOT available to them (as opposed to available to others)? Does their particular context constrain or limit them in any way?

Interview #2

The purpose of the second interview is to allow the participant to further explain their thinking, reasoning, and rationale from the previous interview and again at this phase of the course. Conversation will focus on any affordances they previously identified, how they've enacted those affordances in their design at this stage, and how critiques have shaped their perceptions of successful (and unsuccessful) design decisions.

Questions:

- Please explain how you've approached your design project so far.
- What changes, if any, have you made since the critique?
- How did the mid-term review change your approach, if at all?
- How has the studio space helped or hindered your progress?
- How has this class helped or hindered your progress?
- How has the instructor or your peers helped or hindered your progress?
- What have you learned so far about what it takes to be successful in this course? As an architect?

Prompts:

Prompt students to elicit explanation of their design thinking, paying particular attention to how they access the resources they need to be successful in their design. How do they describe "what's working" in their design and why? Are there any resources they've identified that are NOT available to them (as opposed to available to others)? Does their particular context constrain or limit them in any way? Mention specific affordance-related feedback observed during the previous critique session.

Interview #3

The purpose of the third interview is to allow the participant to further explain their thinking, reasoning, and rationale from the previous interview and again at this phase of the course. Conversation will focus on any affordances they previously identified, how they've enacted those affordances in their design at this stage, and how critiques have shaped their perceptions of successful (and unsuccessful) design decisions.

Questions:

- Please explain how you've approached your design project so far.
- What changes, if any, have you made since the critique?
- How did the mid-term review change your approach, if at all?
- How has the studio space helped or hindered your progress?
- How has this class helped or hindered your progress?
- How has the instructor or your peers helped or hindered your progress?
- What have you learned so far about what it takes to be successful in this course? As an architect?

Prompts:

Prompt students to elicit explanation of their design thinking, paying particular attention to how they access the resources they need to be successful in their design. How do they describe "what's working" in their design and why? Are there any resources they've identified that are NOT available to them (as opposed to available to others)? Does their particular context constrain or limit them in any way? Mention specific affordance-related feedback observed during the previous critique session.

Interview #4

The purpose of the fourth and final interview is to investigate how the final review may have changed their perceptions and bring closure to the data collection process. Conversation will focus on reflection by asking participants about their perceptions of the quality of their work, of the feedback they received during the final review, and what, in their opinion, contributed to their success or failures of their performance in their design work and in the course. Participants will also be asked to reflect upon on the opportunities they are afforded in order to be successful in their studies.

Questions:

- Reflect on your final design. What were the successes and what, in your opinion, contributed to those successes? What do you feel you could have done better?
- Reflect on your performance in this course. What were the successes and what, in your opinion, contributed to those successes? What do you feel you could have done better?
- Please reflect on the final review. Did the feedback from the final review change your perceptions of what it took to be successful in this class?
- What are the characteristics of a successful architecture student, or what does a successful architecture student look like? What are the characteristics of a successful professional architect?

Prompts:

Prompt students to elicit explanation of their thinking, particularly the affordances (material, cultural, historical, social, and technical) they identify and engaged in their approach to their design in the final stages of the project. How do they describe what worked in their design? Mention specific affordance-related feedback observed during the final review. Hone in on what affordances they perceive as being important to becoming a successful architecture student or a successful architect.

Closing:

Thank the student for their participation in the project. Discuss next steps to the study and ask the student if they have any questions about the next steps. Encourage the student to be in contact by email or phone if they have any questions or concerns.

C-2. Faculty Interview Protocol

Four interviews will take place with the instructor of ARCH 201: one interview per month, each lasting no longer than one hour. The protocol for each interview will be the same (Adapted from Gray, 2014):

1. What are the learning goals you wanted your students to achieve in [insert Project here] of the course?

2. What is your perception of students' learning and progress? How are they doing?

3. What, in your opinion, is supporting students' learning? What's helping?

4. What may be hindering students' progress? What is holding them back?

C-3. Studio Observation Protocol

This protocol will examine students' perceived affordances of the studio learning environment on four different dimensions: space, class, pedagogy, and culture. Each of these dimensions is described below, with examples of (1) qualitative characteristics of the environment aspect, and (2) of potential actions to be observed/perceived in studio visits and/or student interviews:

Environmental Dimension	Qualitative Characteristics	Potential actions (effectivities; "allows for")
Studio space	Individual desk space	Storage of personal items; working in studio (rather than working from home) outside of class time
	"Pin up" space	Displaying class-related and personal visual artifacts for reference over an extended period of time
	Meeting tables	Space to meet with the instructor for feedback or display/work on larger artifacts
	Flexible furniture	Spontaneous and structured collaboration for discussion and feedback
Studio class	Long blocks of scheduled time (e.g. 4 hours/3 days per week)	Gives studio precedence over other classes; project takes precedence
	Alignment with other scheduled courses	Practical application of content addressed in other courses
Studio pedagogy	Rapid sequencing/deadlines of projects	Fast-paced, formative focus; emphasis on iteration, process. Assignments/projects become less constrained over time
	Authentic, complex projects	Ill-defined or "wicked" problems allowing for a variety of solutions; cannot "divide and conquer" in teamwork; systematic problem-solving; students' perceived "relevance" to their profession
	Project constraints or parameters	Restricts how students can proceed which limits students' creative options or falling into familiar solutions; promotes early failure
	Critiques (all formats)	Stimulates student reflection, questioning; practicing formal design language; "selling" design solutions/decisions
	Modeling	Instructor offers explicit and tacit guidance on "good design" or productive design practices
	Listening in	Student observes' others feedback, learning from peers; students offer insights, ideas to peers; "intent participation" (Rogoff, 2003)
Studio culture	Learning community	Feeling of collaboration, community, "we're all in this together" mentality
	Untimetabled activity	Working in studio on nights, weekends; feeling of needing, wanting to be physically present in studio
	Emphasis on externalization and reflection	Understandings are externally represented in visible artifact; "making is thinking"; conversation focused on artifact
	Competitiveness	Students "compete" against each other, wanting to impress their peers
	Social, informal	Laidback atmosphere, students talking, joking around; informal relationships
	Learning by doing	Emphasis on process and production, experimentation, experiential learning

C-4. Critique Observation Protocol

Process (Oh et al, 2013)

- *Observation*:
  Critic listens to the presentation and observes what the student has presented; note utterances and non-verbal gestures
- *Noticing*:
  Critic notices the problematic and promising aspects of the design; refer to feedback types
- *Identification*:
  Critic identifies the issues and why they are problematic or promising according to the learning goals of the project
- *Sequence*:
  Critic then considers the order by which the feedback will be given to the student; note the sequencing of the type of feedback
- *Delivery type*:
  Critic decides how the critique feedback will be delivered; note the tone, climate, and how the feedback communicates design knowledge
- *Delivery*:
  Critic delivers critique to the student; note student reaction, rebuttals, and explanations.

Feedback (for noticing and delivery, above; Dannels, 2005)

- Judgement: An assessment of quality, evaluative in tone and includes some interpretation and observation.
- Process-oriented: Focused on students' design approach or process; provides students with observations or insights on their process.
- Brainstorming: Questions or statements that include imagined future possibilities for the design, usually formed as 'what if' statements.
- Interpretation: Critics' reactions to making sense what they see, with questions or comments seeking clarification.
- Direct recommendation: Focused, purposeful statements of advice about a particular design.
- Investigation: Critics request information through questioning about the design or design process; usually initiated to seek a response (versus rhetorical questioning).
- Free association: Feedback in the form of reactive, associative statements; usually begins with "it reminds me of" or "this looks like".
- Comparison: Contrasting the design or the design process with something else in a strategic way, so students can compare their work against another well-known example.
- Identity: References to students place within the context of a larger community of professional practice, culture, identity.