Learning to Be Creative: Key Interactions of the Academic Design Studio

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Abstract: For decades, learning scientists have investigated the nature of creativity. Recently, the *studio* has received attention as an environment in which creativity flourishes. In this paper, we examine the nature of faculty-student interactions through which students learn to think and act creatively in the studio. Grounded in socio-cultural theory and using ethnographic methods, we have collected and analyzed data from five studio classes encompassing architecture, industrial design, and human-computer interaction across three universities. 0ur goal was to tease apart the knowledge and behaviors that were unique to particular disciplines from those common to all the studio classrooms. Results illuminated patterns of student/teacher interactions and classroom norms that foster the development of creative solutions and shed light on the epistemic frames that guide interactions in the studio space.

Keywords: creativity, design, studio, higher-education, ethnography

Introduction

For decades, learning scientists have been interested in promoting creative thought (e.g. Amabile,1983; Guilford, 1987; Lubart, 2001). Recently, the studio has been investigated as an environment in which creativity flourishes. Professional music studios; dance studios; visual artist studios; industrial, interior and graphic design studios and architecture studios are all dedicated to creative acts. Furthermore, these disciplines that value creativity require at least part of their students' education to take place in a studio setting. In an educational studio, "learning to be creative is a situated process entangled with the development of the learner's identity" (Richter, et al., 2014, p. 3). The studio method emphasizes learning by doing, where collaboration among students and faculty is a key factor in developing understanding (Schon, 1983; 1987). Rather than teaching them directly, students are "scaffolded through a creative process that is iterative and non-linear" (Sawyer, 2018, p.150). In an ethnographic study of 15 art and design disciplines, Sawyer (2018) identified the common pedagogical beliefs that faculty use to guide students in learning the creative process, and illuminated how these beliefs influenced the design of studio assignments and supporting pedagogical practices.

In this paper, we respond to Sawyer's (2018) call to extend the examination of studio practices to engineering programs that have adapted the studio method, such as Human Computer Interaction (HCI). Grounded in socio- cultural theory and using ethnographic methods, we have collected and analyzed data from five studio classrooms encompassing architecture, industrial design, and HCI across three universities**.** Like Richter and colleagues (2014), we sought to understand the patterns of teacher/student interaction in the studio and from them, understand what these key interactions had to say about what it means to know within a creative community of practice. Our goal was to understand how the studio is enacted across various disciplinary domains, as well as to explicate the interplay between the social and pedagogical context and its influence on learning.

Following a brief discussion of our theoretical framework and research methods, we will outline our key research findings regarding the common epistemological beliefs and pedagogical practices through which an instructor establishes, facilitates, and sustains an environment that guides students to creative insights in their work. Our results shed light on the epistemic frames (Shaffer, 2006) that guide student and teacher interactions in the studio space, and thus, serve as one model of studio-interactions for those who wish to investigate it further through research or practice.

Theoretical framework

Donald Schön (1987) promoted the idea that studio-based design instruction, used successfully for years in architectural education, could serve as a way for *all* students to learn to participate in the cultural practices of a discipline. Originating in the Bauhaus School of Design in Germany during the early 1900s (Bayer, 1975), the studio method can be illustrated by an example from architecture. In an architecture studio, classes typically meet three times a week for four-hour sessions and students are encouraged to work in the studio rather than at home during off-hours. Students are presented with a design problem that is grounded in the realities of professional practice. At various points in the semester, students present their work to faculty or professional designers for critique sessions intended to stimulate student reflection on and discovery of their developing knowledge through

project reviews and student questioning. These project critiques, or “crits”, can take many forms including desk crits, pin-ups, juries, reviews, and open houses (Dannels, 2005). Through formal presentations and informal conversations, students learn the process and practices of design from each other, from faculty, and from professionals in the field.

Building on Lave and Wenger’s (1991) work on communities of practice, we define the *unique learning environment* of studio as a place where students engage in legitimate peripheral participation in order to develop a complex understanding of the practices of a discipline. To frame a cross-disciplinary understanding of "what makes a studio," we have adopted Shaffer's (2007) definition of studio as a coherent system in which surface structure, pedagogy and epistemology *interact* to create a unique learning community. *Surface structure* refers to the logistics of the studio such as the physical features, setting, space, materials, curriculum, and time block. *Pedagogical activitie***s** include the activities and interactions, such as iterative cycles of design, hands-on investigations, and group discussions of work in progress. And *epistemological understanding* describes the beliefs about the nature of knowledge within the discipline. We are especially interested in how these components interact to establish a unique social context through which creative work is co-produced among instructors and students within the studio. In particular, we seek to understand how an instructor establishes, facilitates, and sustains an environment that guides students to creative insights in their work.

Methods

The present study did not involve a purposefully designed intervention, but rather focused on the everyday practices of the studio-classroom community. Data have been collected in five semester-long courses (one course in industrial design, one course in architecture, and three classes in HCI) at the three universities. The architecture and industrial design programs examined are rooted in the Bauhaus model, as many of the program originators were students of the Bauhaus faculty, either in Europe or the United States. Each student has a dedicated workspace for his/her entire tenure in the program and which he/she may access at any point 24 hours a day, 7 days a week, 365 days a year. Studio classes meet for four-hour blocks of time, three days per week. The HCI courses that are the subject of our investigation were selected because of the expertise of the course professors in implementing the studio method into HCI instruction. As is typical in studio classes, these courses incorporate a series of design critiques where students publicly present their work to their peers and professors. Class projects are completed in teams of students. However, these courses do not provide dedicated studio space for students, nor is the studio scheduled for the extended hours common in the architecture and industrial design studio courses. Because it is difficult for all of surface features present in architectural or industrial design studios to be implemented easily in other disciplines, one key aspect of our work was to identify how the pedagogy, epistemology, and community of practice co-developed within the studio space.

Data sources and analysis

Our data set for each of these five courses consist of over 100 hours of videotaped recordings of classroom interactions, transcripts of all public electronic announcements, student design journals, and discussions (via listserv, discussion boards, and chats), and any documents distributed to the group by faculty, students, or advisors. In addition, instructors reflected on their classes at periodic intervals to make explicit their decisions guiding the class as well as their “reflections-on-actions” (Schon, 1983).

Video was viewed in full at least two times, with sections of the video watched multiple times in a more detailed analysis of dialogues and action. The first level was large-grained and holistic. While watching the video, the analysts composed a written narrative marked frequently with time stamps. The second level identified Significant Events (SE) or segments of the narrative and analyzed it in greater detail, emphasizing dialogue, content, and the kinds of tools the participants were using. The third level was microgenetic, in which representative SEs were identified and analyzed for participants’ use of questioning, metaphors, analogies, and tools.

Data were analyzed through the well-established constant comparative method (Merriam, 1998). This approach requires an iterative process of collecting data, identifying major and recurring themes in the data, developing categories for these themes, coding the data, and synthesizing categorized data within a larger context that identifies essential relationships and processes (Bogdan & Biklen, 1998). Repeated cycles of analyzing multiple data sources ensures that triangulation is built into the analytical process and leverages a key strategy for increasing the validity and reliability (Merriam, 1998). Both authors were involved in working with several research assistants in the data analysis.

Each of the five courses served as one case study (Merriam, 1998; Stake, 1995). Each case was analyzed within-case for elements essential to the studio approach. For each course, videotapes of class activities, instructor- and student-generated artifacts, and instructor reflections served as the primary sources of data. The

instructor reflections widened our understanding of events in the classroom and their relationship to the studio experience. Instructor- and student-generated artifacts were used to inform not only the processes critical to a studio approach but also the meaningful products, both in draft and final form, of a studio approach.

The specific patterns of interaction presented here were developed through cross case analysis of the five cases to discern studio patterns. We initially generated a list of 40 reoccurring patterns that seemed representative of the instructor's beliefs about the nature of teaching and learning in their studio. For simplicity, we called these *studio guidelines* as they seemed to represent the principles that the instructors used to guide their actions in the studio. For example, through their dialogue, the students and instructors in each studio classroom established meaning around language that was specific to the discipline or to the particular design studio of which the students were a part. These observations resulted in the guideline "establish a common language to communicate design ideas". The 40 guidelines were annotated with example data from the five cases and grouped in the coding categories of surface structure, pedagogy, and epistemology. In order to further reduce the number of guidelines, we examined the list and supporting data to identify themes across coding categories. Through an iterative process, the initial list was further reduced to a list of 14 guidelines representing the instructors' beliefs about the nature of teaching and learning in the studio. And finally, the 14 guidelines were reviewed to identify the *key patterns of interaction* that surfaced through our analysis. Throughout the process, the studio instructors provided insight on the patterns that emerged.

Results

We originally defined the studio as a unique learning community where students engage in legitimate peripheral participation in order to develop their professional identity within a community of practice (Lave & Wenger, 1991). We quickly came to see that although the studios were situated in professional communities of practice, and as such, focused on preparing students to adopt the tools, practices, and beliefs of that professional community, they were also situated in, and a part of, a particular academic culture, with its unique set of tools, practices, and beliefs. We came to see the studio as a unique "*practice community"* (Barab and Duffy, 2000) that serves as a bridge between academic and professional communities (see Figure 1).

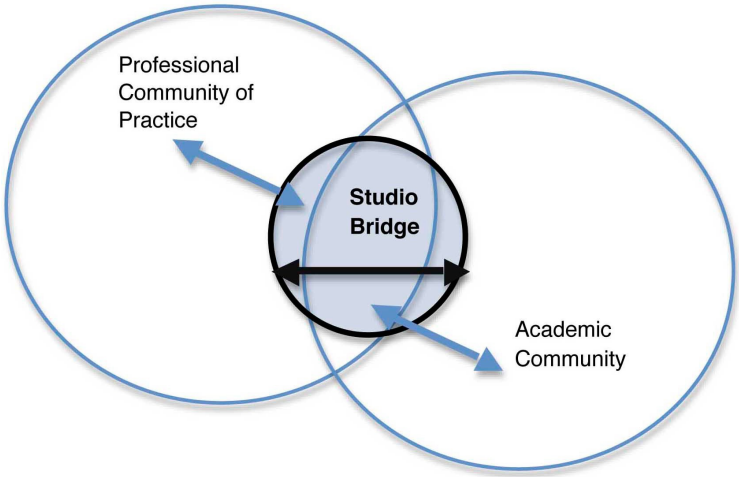

Figure 1. The studio as bridge between professional and academic communities of practice.

As a bridge between professional and academic communities of practice, we found that effective studios a) provide windows to the professional community, yet provide opportunities for experimentation, free from the constraints of professional practice; and b) exhibit a collaborative epistemology, where students have the responsibility not only to do their own work, but to critique one another, to contribute to the design thinking of others, and to be reflective. These patterns of interaction reflect the epistemic frames (Shaffer, 2006) through which studio participants define what it means to develop and apply the creative practices of a discipline. Each of these key ideas will be discussed in detail below.

Windows to the professional community with opportunities for experimentation

The exercises and projects in each course mirrored the kinds of complex design problems that a designer within that domain would encounter in the professional world. Students were asked to design interfaces in HCI, buildings in architecture, and products in industrial design. At times, the results of the assignments become part of the larger

design community as when students in industrial design were charged with designing an innovative tea kettle to enter the Tea- Off Design Competition sponsored by World Kitchen. Other times, the projects are created to examine concepts in ways that are not possible within the constraints of professional practice.

Within the academic design studio, students are encouraged to expand their individual perspectives through looking at their design problems in new and different ways. For example, as the industrial design students were refining their designs for a medical hand dispenser, one student was trying to develop a non- threatening alternative to a syringe for children's vaccinations. The student developed a series of toy-like sheaths that could be fitted over a syringe, which generated much discussion among his classmates. The instructor responded to his presentation:

> I'm not fully convinced this is the right solution. And it may yet be with some modification, but you've stayed on this. It goes back to my point from the very beginning. I'd like to see you depart from, big time. Just go to an extreme from that. Forget about the sheathing, and start thinking about actually redesigning the syringe. And just see. It may be, not, you know, the better path to take. But I want you to think that way. I mean, what if it were a pancake instead of a cylinder. Maybe it's just something I slap on the arm, and the doctor does that. And something about that activity lets me see as a doctor what I'm doing."

As a bridge to professional practice, the academic design studio is a place of experimentation, where students have a chance to develop as designers *without* the constraints of the workplace. Students are provided with the space and time to generate multiple ideas and then refine those ideas based on certain criteria. They present their design ideas while still ill-formed as they share their work-in-progress and benefit from the enriched perspectives gained through interactions with peers and faculty.

The value of the "intermediate" crits or pin-ups, where students present their early design concepts as they are struggling to make decisions, cannot be overstated. For example, one group in the HCI studio presented many rough sketches and an array of design ideas to the instructor during a desk crit. This group received a thoughtful critique from the instructor, while another group had a very polished presentation that was favorably received, but yet the critique lacked the detail, largely because the group had completed their work and the iterations of design ideas were not transparent. Through examining a range of design solutions, the instructor is able to understand the reasoning and the design-based thinking through which the students were moving. Intermediate crits also allow students to contribute to one another's thinking and to expand their design repertoire. In addition, students are encouraged to explore a wide variety of potential solutions through multiple media. For example, one HCI project required the students to develop a sprinkler system control and display. They began by creating a storyboard using a series of 3 by 5-inch cards that acted as a prototype upon which to conduct usability studies. Teams videotaped volunteers testing the interface and used the video as part of their project crit. It was in this project assignment, coupled with the crit, that students began to make the connection between programming and designing an interface with the user and context in mind.

Furthermore, as students present their ideas in studio critiques and converse with faculty, students, and guests, they develop, tryout, and refine a language to express their design ideas. The following discussion illustrates how students develop their professional language through interactions with practicing professionals, while safely embedded within an academic learning environment.

On a Saturday prior to each project crit, the architecture instructor invited guest architects to a daylong pin-up to review the students' designs. In almost every crit, the comments by the guest architects focused on the context of their designs, that is, how their designs sat on the landscape in relation to the existing structures. These conversations forced students to literally "ground" their design in a way they had not considered before. The guests and the students talk about the "experience" of the building. For example:

> Guest 1: "Looking at this one, for example (goes up to second student's proposals), so much of this building is about the experience and the procession to it . . . and it seems like this scheme is more of a mental thing, it's not an *experiential* scheme. It doesn't show what the experience would be like. It's a mental connection in a drawing. When you're there, you may not experience that….So how do you connect a little bit more with the nature, with what's existing there?"
>
> Guest 2: "What you end up with: does it respond to the site well? Does it respond to the function? Does it work?"

The exchanges among the guests and the students also highlight another pedagogical feature of the project crits –

the role of questioning by the instructor (or guests). When the instructor had to ask too many questions, it was obvious to both the instructor and students that either the student's preparation was inadequate or they had not formulated in their mind how to articulate their ideas and coordinate their narrative with the designs they chose for presentation.

At one point during the crit, the instructor said to a student:

> I think if we haven't talked about your project that you should at some point run and get your concept model because it's much clearer when you can kind of see where he started and then just the kind of pacing of the three. So it's another example of your just not bringing enough really to support what you're trying to say.

Guest 2 disagreed by saying, "There really is such a thing as bringing too much to the table." The instructor's response reinforced the place of the studio as part of the academic community by inferring that at this point of their development, the supportive materials are necessary, "Not in second year. No. I've never seen anybody bring too much."

This exchange also illustrates how studio faculty link students with the larger professional community through the use of invited guests who provide lectures, workshops, and critiques of students' work. Not only do these multiple perspectives contribute to creative thought (e.g., Amabile,1983), but they are also valuable in building trust and fostering social relationships among the studio students, faculty and professional community.

Collaborative epistemology

Effective studios exhibit a collaborative epistemology, where students have the responsibility not only to do their own work, but to critique one another, to contribute to the design thinking of others, and to be reflective. Teachers and students adopt a stance regarding what constitutes "knowing" and how that knowledge is constructed that is radically different from traditional courses. Cobb and his colleagues (e.g., Cobb, Wood, et al., 1992) adopted the term "norms" to refer to the "taken-as-shared" rights and duties that guide students and teachers as they co-construct knowledge within the classroom. Intricately tied to professional norms, the classroom norms establish a set of explicit and tacit expectations for each member of the learning community.

The rights and duties of the studio classroom are patterns of interaction that position both instructors and students in a social and discursive construct (Harré et al., 2009). These patterns reflect the constantly changing social actions of instructors and students as they take up the work of the design studio. A foundational studio norm consistent across disciplines and essential to the functioning of these patterns of interaction is establishing students' social identities as designers and creators. A social identity is both a social and discursive move that establishes a sense of permanence and membership within a group, as well as a shared conception of boundaries for that group (Bloome et al., 2005). We have found that instructors in the design studio immediately refer to students as "designers" and "architects" a labeling that both solidifies students as respected contributors to the work of the studio where participants hone their skills and expertise as they prepare for the professional field.

For example, in the second-year architectural studio, the instructor uses the collective first-person pronoun "we" at all points, signaling to the students their positioning as a community, their equal status as architects along with the instructor, and the emphasis that their individual design processes will form a collectively shared group experience in the studio. Throughout, she also refers to her students as "architects," not as students. She puts faithful, professional, and respectful confidence in each student's presence in the architecture studio, engendering an expected culture of professionalism and positivity.

Students, however, sometimes struggled with this responsibility (Root, Rosso-Llopart, & Taran, 2008). For example, during a critique in architecture, a student commented "Upon your suggestion, that's actually kind of a good idea." Despite the student's temptation to look to the instructor as the authority figure, the instructor returned the responsibility to develop a sense of design back to the student, replying "It's not a suggestion, it's just a question, I'm just trying to understand how you're seeing the space."

The same instructor also reminds the students that she is there to learn alongside them, stressing that architecture can never be mastered, but simply continually practiced. This positioning levels the power structure of the studio away from the typical student–instructor learning model to a communal model of learning. This foundational norm of shared social identity creates social and discursive membership into the studio space, which as previously described, shares permeable boundaries with both the professional and academic communities.

However, while establishing students as designers engenders the expected social patterns of the studio and serves to equalize the positioning of instructors and students in the design field, instructors still retain a positioning of expert coach (Schön, 1987), which maintains the instructors' footing as "master" designers and creates boundaries of respect that student designers maintain. In another example from the second- year

architecture studio, the instructor verbally provides the students with a "big-picture" overview in the first week of the semester. She gives them specific guidelines for working in the studio, reminding students that the studio is a community working environment in which students and instructors will all learn from each other; that individual development as architectural professionals is expected; that studio is a reflection of the design process in that designs and projects can often get "stuck," and therefore the need for community and for flexibility is essential; that they are embarking on individual and collective paths "into the unknown" of architectural design; and finally, reminding them that architecture is a process of practice and not of mastery.

We have found that project crits are a critical experience around which the collaborative epistemology of the studio is developed in each discipline. Cossentino (2002) describes project crits, or what she refers to as "exhibition", as a "purposeful movement toward artistry" via the process of performance and criticism (p. 42). The project crits in our data were all generative—that is, instructors and students reflected-in-action (Schön, 1984) around evolving designs, emphasizing a socialization into the art of critique via project crit performance rather than on the student as subject of critique. As Cossentino (2002) notes, reflection-in- action around project crits makes partners of instructors and students. Reflection-in-action helps to establish the essential rights and responsibilities of the studio: all input is valuable, all design decisions are valid as long as they are reasonably defended, and designs are dynamic representations of changing knowledge and perceptions. As students "exhibit" their work in project crits, they are carefully and professionally presenting their ideas to an expert coach, while working in partnership with their expert coach to refine design iterations and resolve design problems in the context of performance and criticism in the studio. Other students "listen-in" and observe their peers as they negotiate the project crit, which is a form of active participation (Rogoff et al., 2003) in the studio. Because student observers are not only expected to comment on the project crits of their peers, but will themselves take part in project crits as presenters, these students are keen observers and listeners in anticipation of their own project crits (what Rogoff et al. [2003] call "intent participation").

Reflection-in-action and listening-in were frequently observed in the industrial design and architecture studios. For example, during a small-group project crit, an industrial design student practiced reflection-in- action as he presented 11 drawings of his ideas for a medical hand dispenser to the instructor and group. The group organized their chairs around him in a semicircle as he talked, reflecting on the many design variations he had compiled. The instructor and students from the group freely commented on his designs, also helping the presenter enter into reflective thinking on his design processes while he presented. While this project crit occurred, the remainder of the students in the studio were working independently at their work spaces. A student who was busily working at his desk suddenly chimed into the project crit, telling the student about a neighbor's medical condition and aspects of it that would be perhaps important to his design iterations. This student was listening-in to the project crit both literally and metaphorically: his proximity to the small project crit made hearing the conversation possible. But the information he gave to the presenter was very pertinent to the design questions he reflected on as he presented.

In an atmosphere in which the instructor serves as an expert coach while respecting students as novice designers, faculty let the key ideas of the discipline emerge through the students' work on design problems and the associated discourse. Students are presented with a project brief that is designed to illuminate certain ideas. Faculty use the project critiques as the time to point out key ideas and to push students to come to see key ideas on their own. For example, at one point during a project crit in the architecture studio, the instructor asks: "What did I ask every single group?" A student answers: "orientation." The instructor explains that the typical orientation of design on a page is where "north is up." In this way she signals to students the conventional way to proceed with designs on paper. By waiting for every group to NOT mention orientation and by not making it an issue during presentations, she doesn't single out groups or indirectly find fault with any one person. The instructor makes an instructional point in a meaningful and nonthreatening way, while also emphasizing the conventions of architectural practice. These meta-level discussions provide instructors with the opportunity to identify essential concepts, behaviors, and skills.

Faculty ground their discussions of key concepts in the students' projects. This occurs most publicly during the project critiques, but also occurs during informal interactions during studio work time. The instructor of the architecture studio noted that: "When I *do* talk to students at their desk, I make an effort to engage their neighbors in the conversation. Or, I might call across the room to another student who has a similar issue in their work and bring them over… And, more often than not, I'll see something during the conversation that applies to the whole class, and will bring the whole class together to talk about it. In this case, everyone is in a sense always 'on'." Instead of lecturing and then providing practice on the concepts through assignments as in traditional classes, studio instructors let key ideas emerge through student work and related discussions.

Discussion

The results of this study shed light on the social and pedagogical context of the studio and its influence on learning. Through providing links to the professional community, coupled with opportunities for experimentation, we have found that instructors seek to establish certain *habits of studio* which are consistent with accepted attitudes, dispositions, and practices of a discipline. Elsewhere, we have discussed differences in the epistemology (Brandt, et al., 2013) of the disciplines as well as differences in how they facilitate creative thought (Cennamo, et al., 2011). In our analysis we found very different conceptions of epistemology, or what constituted ‘‘good design” and noted how these conceptions were linked to disciplinary and academic cultures in which the studio was situated. For example, industrial design used a reflective practice paradigm in which the uniqueness of the design problem—examined through discussion in the design critique—resulted in subjective interpretation. On the other hand, the HCI faculty in our research project applied a problem-solving paradigm that valued a logical, step-wise analysis of the design problem and empirical data of usability. In our search for the essential elements of studio-based learning, we came to see that an understanding of how to apply a studio-based approach depended to some extent on the way that design was leveraged within a particular discipline.

Despite these differences across disciplines, one intent of our research was to tease apart norms that were common to all the studio classrooms from those that were specific to a particular discipline. For example, the shared assumption that students should be able to explicitly justify design decisions is an expectation of designers across domains, while the particular justification provided would be specific to a discipline. As such, the common patterns of interaction, these habits of the studio practiced across the various studio settings, have figured prominently as we come to understand the value of the studio as a pedagogical practice. All of the studios we observed exhibited a collaborative epistemology, where students had the responsibility not only to do their own work, but to critique one another, to assist others, and to be reflective.

Above we described particular practices, ways of speaking, and structures of interactions that induct students into professional practice and guide their creative expression in the design studio. While each discipline differed on what constitutes “good design,” these discussions and practices around creativity are what Holland and Lave (2009) would describe as the cultural imaginary for forming the “history-in-person.” These cultural practices in the design studio are the local contexts for self-authoring as students come to understand what it means to be a designer in their chosen field. As the students’ creative work is recognized or held up as exemplars, students begin to invest in developing identities as designers.

As is true of any ethnographic study, we recognize the limitations of conclusions drawn from a limited set of data. Yet, coupled with the results of other studies such as Richter, et al. (2014), our work contributes to the growing knowledge of the key interactions that contribute to the “cultivation of creativity” (p, 1) in an academic design studio. Tacit rules and habits of the studio guide how meaning is made and how creative acts are practiced in studio-based learning. Practices, beliefs, and knowledge claims in the studio establish epistemic relations to the tasks at hand and the social interactions that surround them (Carvalho & Dong, 2009; Dorst & Dijkhuis, 1995). The habits of studio are simultaneously processes and products of the studio ecology: as students negotiate the studio environment and engage in the rights and responsibilities of studio interaction fostered by the instructor, the studio evolves on superficial, epistemological, individual, and community levels. As students become more proficient in these habits, they begin to produce more creative and highly developed products that are directly related to the very social and epistemological processes they come to understand, refine, and meaningfully regenerate for themselves and their peers over the semester.

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