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DESIGNING AN AESTHETIC LEARNER EXPERIENCE: UX, INSTRUCTIONAL DESIGN, AND DESIGN PEDAGOGY

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In this design case, we describe a multi-year process during which a team of faculty designed a four-year undergraduate major in user experience (UX) design at a large research-intensive institution. We document the program- and course-level design experiences of five faculty members. This multi-year process has culminated in a dual-strand, integrated studio learning environment. Two types of studios—"learning" and "experience" studios—form the core of the program, with learning studios allowing cohort-specific skills development and practice, and experience studios providing cross-cohort opportunities to work on industry projects. We detail our process of developing this course sequence and the program-level connecting points among the courses, identifying institutional supports and barriers, the unique and varied skillsets of the involved faculty, and the growing agency and competence of our students in the program.

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INTRODUCTION

In the past decade, the demand for design-related jobs has grown dramatically. Companies such as IBM and HP have adopted a "design-first" strategy that recognizes the value of user experience, and other innovative companies such as AirBnB have built their reputation on a foundation of design. Fields such as human-computer interaction (HCI) have recognized the value of user-centered design for decades, yet have traditionally offered only graduate degree options in fields such as HCI, information science, and human factors. The primary academic governing body for HCI, ACM SIGCHI, has even gone as far in previous reports as to state that the discipline should remain graduate-only until it matures further (ACM SIGCHI, 1994). However, in the last decade there has been a surge of interest in HCI educational practices (e.g., Churchill, Bowser, & Preece, 2016; St-Cyr, MacDonald, & Churchill, 2019) and a dramatic rise in demand for user-centered designers—often under the umbrella of UX design. While undergraduate HCI and UX education is still nascent (Vorvoreanu, Gray, Parsons, & Rasche, 2017), the rise in industry demand presented an opportunity for us to develop a novel undergraduate UX design program.

In the last four decades, the discipline of human-computer interaction has emerged as a combination of computer science and applied psychology. In its evolution, HCI has expanded through three well recognized "waves" or paradigms in which it has increasingly recognized the value of other disciplines (Bødker, 2006; Harrison, Sengers, & Tatar, 2011). This recognition has resulted in a somewhat unique trans-discipline, which has synthesized concepts from

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psychology, anthropology, visual design, organizational strategy, industrial design, critical theory, and comparative literature, among others. This diversity and range of disciplinary traditions is perhaps one of the reasons why undergraduate programs have been so elusive and was one of our most formidable challenges in developing a cohesive and transdisciplinary undergraduate curriculum. In parallel, there was increasing industry demand for UX graduates that was not being met by traditional graduate education, creating a space for us to pursue an undergraduate offering.

DESIGN CONTEXT AND TEAM

Within this context of changing market expectations and an increase in design-first approaches in industry, an undergraduate major was approved at Purdue University, a research-intensive institution in the Midwestern United States, in 2015. As part of the program proposal led by Mihaela, three new faculty members were hired to begin in the Fall of 2015 to build out and teach the courses in the residential undergraduate program. While the program was initially intended to span both web development and user experience (UX), by the time these faculty were hired, the program had converged to focus only on UX. Colin was hired to lead the instructional design of the major, focusing on the studio sequence and overall program design.

The College and Department

The program was approved within the Department of Computer Graphics Technology in the Purdue Polytechnic Institute. The Polytechnic Institute is one of ten academic colleges at Purdue University and has historically focused on the intersection of academic research and industry application within the framing of technology. Within the department, which includes around 30 faculty members, this was a time of expanding majors, with most new majors referencing computer graphics, 3D modeling, or simulation in some way (e.g., animation, game studies, building information modeling, virtual product integration). The closest program related to UX was a major in web programming and design, which was originally intended to be a parallel track of the new major in UX.

In tandem with these curriculum development efforts, the college was ramping up a curriculum transformation effort, and the UX major was the first completely new program as part of that effort. The UX major intentionally incorporated industry involvement, modern learning approaches (as defined by the college curriculum transformation; cf., "Polytechnic Transformation," n.d.), project-based curricula, mentoring, and other indicators of a 21st-century curriculum in response to the college-wide transformation effort. The transformation effort, which is ongoing as of the time of this writing, focuses on incorporating "innovative learning environments, integrat[ing] humanities with technical studies in a learn-by-doing atmosphere, and offer[ing] new options for majors and for earning a degree" ("Polytechnic Transformation", n.d.). As part of the program blueprint (Vorvoreanu & Connolly, 2015), Mihaela identified two different types of studio experiences that would form the core of the UX major: learning studios, which are cohort-specific and focused on building fundamental design knowledge and skills; and experience studios, which include members of all cohorts that work on real projects from industry partners. These studios and their development are elaborated in a later section.

Faculty Team

As part of Mihaela's work to draft the program- and course-level documents to get the major approved, she led the efforts to hire three more faculty to begin in Fall 2015. These hires were intentionally structured to bring in diversity of academic and industry backgrounds, while maintaining a core emphasis on UX and HCI.

- **Colin** (started in August 2015) has a background in studio education, having previously earned a Bachelors's and Master's degree in graphic design. He has an industry background as a visual designer, serving as an art director prior to his doctoral work. Since then, he has studied studio pedagogy as a researcher, and has focused on bringing humanistic approaches to user experience (UX) design education, particularly in the context of human-computer interaction (HCI). He has Master's and Ph.D. degrees in instructional design. Colin led the creation of and teaches learning studio 1, 2, and 5 and contributed to the design of learning studio 3 and 4. In addition, he contributed to the design of the multi-level experience studio.
- **Paul** (started in August 2015) has a background in computer science and cognitive psychology, with a focus on cognitive approaches to information visualization and human-computer interaction. He has a terminal degree in computer science. Paul completed a two-year postdoc with IBM Research in Toronto prior to joining Purdue. Paul teaches and was the lead designer for learning studio 3 and co-designed learning studios 2 and 5. He also co-teaches learning studio 5.
- **Austin** (started in August 2017) has a background in computer science and human-computer interaction, with a focus on feminist and care theory and community informatics. He has a terminal degree in HCI. Austin designed and teaches learning studio 3 and 4.
- **Nancy** (started in August 2015) has a background in industrial design. She has an MFA in interaction design, as well as industry experience in product design. Nancy has iteratively designed and led the multi-level experience studio.

- **Mihaela** (originator of the program; left Purdue in 2017) has a background in communication, with a focus on how companies build their identity using websites and other social media resources. Mihaela led the administrative and conceptual development of the major and served as program lead until Fall 2017 when she left Purdue to join Microsoft Research.

As members of this team collocated at Purdue, we all committed early to meeting weekly and jointly participating in the curriculum design and development process. However, we quickly developed areas of specialty, with Mihaela, Colin, and Paul quickly converging on issues relating to the learning studio strand, and Nancy leading the experience studio strand with advice from the other faculty members. During their first semester on campus, the new faculty were exempt from teaching so they could focus on developing the courses in the new program.

Building a Functioning Team

The program's success depended on the newly assembled faculty team. Mihaela focused her attention on nurturing the team and its culture. Her main concern was that, as the new faculty members were hired to execute on an already approved curriculum, they would not have a sense of ownership. Thus, her priorities as team lead were to build a sense of ownership and a team culture of trust and safe collaboration.

To build a sense of ownership among the new faculty, Mihaela made several explicit decisions. Instead of only allowing faculty to revise elements on the course level alone, she opened the entire curriculum for revision. She asked the new faculty to consider what had been done before, and to propose any changes, no matter how deep. As we explain in the section on curriculum development, the team decided to keep the core principles and structure of the initial curriculum, but heavily revised the competency strands and learning objectives, which informed additional decisions on the course level. Mihaela also decided to refrain from teaching in the program, so that the new faculty could immerse themselves in the new courses and define them as they chose. Additionally, Mihaela aimed to play only an advisory role in decision making, enabling each faculty member to make the decisions that impacted the courses they were designing and teaching.

To build a team culture, Mihaela asked that the team meet once a week, even when there were no pressing matters to discuss. In those meetings, the team often shared a meal and chatted about professional and personal topics, while also addressing pertinent curriculum tasks. To create a safe environment where it would be "okay to be wrong," Mihaela also solicited feedback on her own courses and syllabi and asked for advice with her own teaching. She hoped that this would encourage vulnerability in the other team members, with the goal of creating a relaxed, informal atmosphere at group meetings.

VALUING LEARNING AND DOING

From the beginning, Mihaela advocated for a program design that included a combination of academic preparation and real-world practice. As part of this goal, two studio strands were developed that follow the student throughout their program: "learning" studios (LS) and "experience" studios (ES). Roughly speaking, learning studios were intended to be a heightened view of reality (i.e., a confluence of challenges unlikely to be confronted in a typical job) and roughly analogous to "going to school," while experience studios were analogous to "going to work" with all of the chaos that this entailed. LS was intended to be cohort-specific, where students could learn skills in an integrated and cohesive way with authentic projects that had resonance with the "real world," while ES was intended to be a cross-cohort application and sharing of learned skills among students at multiple levels in the program using authentic industry projects. This structure of learning and experience studios was already approved by the curriculum committee, but the courses had not been built out or taught. Thus, the idea of these two studios existed only in nascent form when the new faculty arrived in Fall 2015, and it was unclear how these studios would fit together or what activities students would engage in during each studio session (see Figure 11 for the final curriculum plan).

Values that Guided Our Work

We began our work by reconciling how we intended to collaborate as a team, the kind of student experience we wished to create, and our overall teaching and curricular philosophies. Because we came from significantly different, yet complementary, disciplinary traditions and contexts, and had not previously taught or worked together, the identification and reconciliation of the values that drove our work was important to recognize.

As we began to identify aspects of the student experience, we were guided by active learning practices in general, and the transformation principles set out by the college in particular. As part of the college transformation, ten principles of modernized teaching and learning served as guideposts for our development efforts:

1. *Theory-based applied learning;*
2. *Team project-based learning;*
3. *Modernized teaching methods;*
4. *Integrated learning-in-context curricula;*
5. *Integrated humanities studies;*
6. *Competency credentialing;*
7. *Senior capstone projects;*
8. *Internships;*
9. *Global/cultural immersions; and*

10. *Faculty-to-student mentorship* (Polytechnic Learning Environment, n.d.).

These principles, in addition to active learning principles taught in an instructional innovation program on campus called IMPACT (IMPACT, n.d.), served as one type of aspirational goal for our student experience. In addition to these more general goals, we also reached an agreement to focus on just-in-time learning, the development of designer identity, integration of topics and learning experiences, and the development of community through mentorship.

Beyond these elements of the student experience, we also had early conversations about the appropriate instructional design methodology to use. While Mihaela began this process through the "backwards design" methodology (Wiggins & McTighe, 2005) favored by IMPACT trainers, Colin sent several papers to the team early in Fall 2015 advocating for an experience-first approach to curriculum design (e.g., Boling, Siegel, Smith, & Parrish, 2013; Parrish, 2005; 2008). This different perspective prioritized the aesthetic learning experience over learning outcomes and led to conversations among our team regarding the *experiences we wanted students to have*.

Learning Studios

We knew from the beginning that the learning studios would be the place for students to learn new skills. What was less clear is *how* these skills would be built, in which order, and with what priority. Over time, we sequenced a set of learning outcomes—linked to design methods and activities—to ensure a baseline of student expertise in UX-related approaches to design.

Experience Studios

The experience studios were intended to provide students an authentic experience working with industry partners, while also offering opportunities for mentorship and leadership. This was meant to be accomplished through the creation of cross-cohort project teams, with freshman, sophomore, and junior-level students working together for an entire semester to address the industry-sponsored project. Thus, we had to build the course with three overlapping cohorts/years of UX student cohorts in mind, but with the realization that it would take three years to see a multi-cohort set of students in reality. As we iteratively built towards the final overlapping cohort design, the ES framework had to remain malleable, while also encouraging leadership, collaboration, and project management, even when students were of roughly the same cohort level.

In the first iteration of experience studio, students came from a variety of other computer graphics majors, representing a range of abilities and classification levels that provided value when staffing projects. In the second and third iterations, as we built towards the fully overlapping cohorts, the ES framework increasingly grew from purely "managed chaos" to a hierarchy of interns (first-year students), employees (second-year students), and managers or team leads (third- or fourth-year students).

FROM EMPTY CONTAINERS TO INTEGRATED STUDIOS

Colin, Paul, and Nancy began in August 2015 with a new program and a blank slate. All of the courses required for the new major—five learning studios and three levels of experience studios—had been identified and approved, and all that was left was to fill the many "empty containers" with content and instructional strategies. This was a daunting task since the only aspirational programs or direct peers were Masters degrees, which took place over less time with a generally more research-focused rigor. Thus, our first substantial challenge was to identify the necessary content and determine how it would be distributed across the curriculum. A total of eight courses needed to be "filled," comprised of the five sequential learning studios (15 credits) and five iterations of experience studios (15 credits). The experience studios were intended to be taken in parallel with the learning studios over the same period of time.

In documenting the content that was required and how it might be distributed, we relied extensively upon design precedent from existing successful graduate programs and Colin's prior research on the competencies of UX practitioners (e.g., Gray, 2014; 2016; Gray, Toombs, & Gross, 2015). Even given this substantial precedent knowledge, it was difficult to assess what knowledge was critical, what was desirable, and what was merely traditional or "expected."

As Colin and Nancy brought their ideas about Learning and Experience Studios to the team, Mihaela, for the most part, supported their decisions even on the few occasions when she did not fully agree with them. She estimated that the faculty's sense of autonomy and ownership was more important at this stage of the process than making the "right" decision. For example, she was not convinced that Colin's proposed approach to run 4 complete design projects in Learning Studio 1 would work, but after asking a few questions, she did not press the matter further. Similarly, she had envisioned that the Experience Studios would not have much emphasis on deadlines and graded deliverables but supported Nancy in her decision to use more structured methods of assessments and deliverables.

Building a Competency Map

We began the process of designing the program by stepping back and working at the program level. We wanted to identify the main skills, competencies, methods, and core knowledge that we would expect students to gain over the

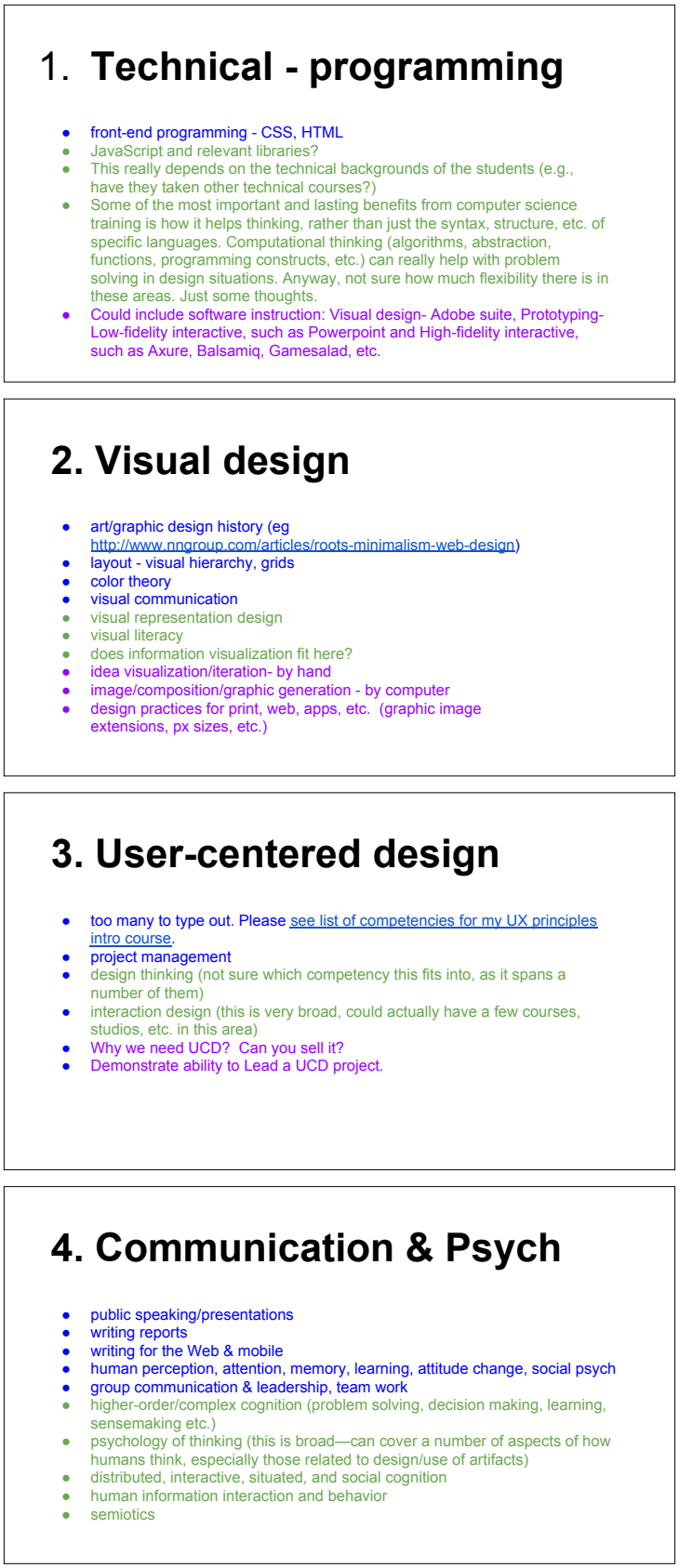

FIGURE 1. Sample Google Slides with annotations by program faculty. Blue notes were from Mihaela, green notes were from Paul, and purple notes were from Nancy.

four-year program. Mihaela identified initial objectives, which Paul and Colin attempted to address in the summer of 2015 before meeting for the first time on campus. Colin was not able to contribute during the summer due to travel, but he did connect with Paul via Skype to discuss alignment with the programming and user-centered design goals of the program. We worked collaboratively in Google Slides, both synchronously and asynchronously, to address the following goals:

1. *Create detailed learning objectives for all learning studios.*
2. *Identify competencies and outline a badge system that spans the entire curriculum*
3. *Figure out transfers into HCDD [human-centered design and development] from CGT [Computer Graphics Technology]* (quoted from Google Doc verbatim)

Of course, these goals were daunting. We had not yet met each other in a collaborative context and were not yet aware of each other's instructional philosophies, areas of expertise, or beliefs about UX.

In previous meetings, Mihaela had worked with an internal team to design the major, and they had identified the following competencies or learning outcome areas, with some areas of concern (text copied verbatim from the internal team's notes):

1. Technical (programming)
2. Visual design
3. User-centered design
4. People-related (communication, psychology)
5. Entrepreneurship *(ENTR program is freaking out about this, need to touch base with them)*
6. Global conscience

These six competency areas became our focus, and each team member (except Colin) added text using color-codes, an intentional decision that allowed us to maintain connections to individual contributors (Figure 1). Building on these competency areas, we identified the early objectives for our new team, which were the following:

- *What should the learning objectives be for each LS (learning studio), and*
- *How do we deliver each LS so that we integrate programming, visual design & UCD [user-centered design] in each LS?*

In August 2015, upon arriving at campus, the department head gave all new faculty a course release to focus intensely on the design of the program. At this stage, Colin began to take the lead on curriculum and

program design, using all of the materials that had been developed thus far in the approved curriculum documents and the Google Slides materials. He took these initial ideas, expanded them through conversation in regular UX team meetings, and created a large number of Post-It notes. These notes were not built from the Google Slides directly, but rather referenced materials from existing HCI or UX texts, research papers on required HCI competencies, and existing course syllabi from Purdue and other institutions with the goal of documenting the skills we would want a student to develop during the program. Using an inductive, affinity diagramming approach (Martin & Hanington, 2012), these blue Post-It notes began to coalesce into the following categories:

- Design (UCD Focus) Philosophy
- Social/Research
- Technical
- Visual/Interactive (static v. dynamic v. physical)
- Entrepreneurship
- Global Consciousness

For each strand, Colin attempted to identify high-level skills with blue Post-Its (e.g., sketching, wireframing, color theory, problem framing) and existing design methods in yellow Post-Its. He then followed these up with magenta Post-Its for meta-methods or approaches (e.g., contextual inquiry, participatory design, reflection) and green Post-Its for "hidden" learning outcomes that would likely result from the acquisition of the above skills, methods, etc. (e.g., managing chaos and ambiguity, listening, embracing constraints, risk-taking, empathy). The colors and areas of focus were somewhat arbitrary and were selected as one means of dealing with the complexity of the task. As a trained critical theorist, Colin used this progression from concrete to "hidden" learning outcomes to document the desired competencies of graduates, which could then be used to map activities and projects onto individual semesters, which would hopefully result in these outcomes.

These strands were then used as a point of discussion with the team in planning the next steps. One of the challenges that immediately surfaced was: "How do we sequence these

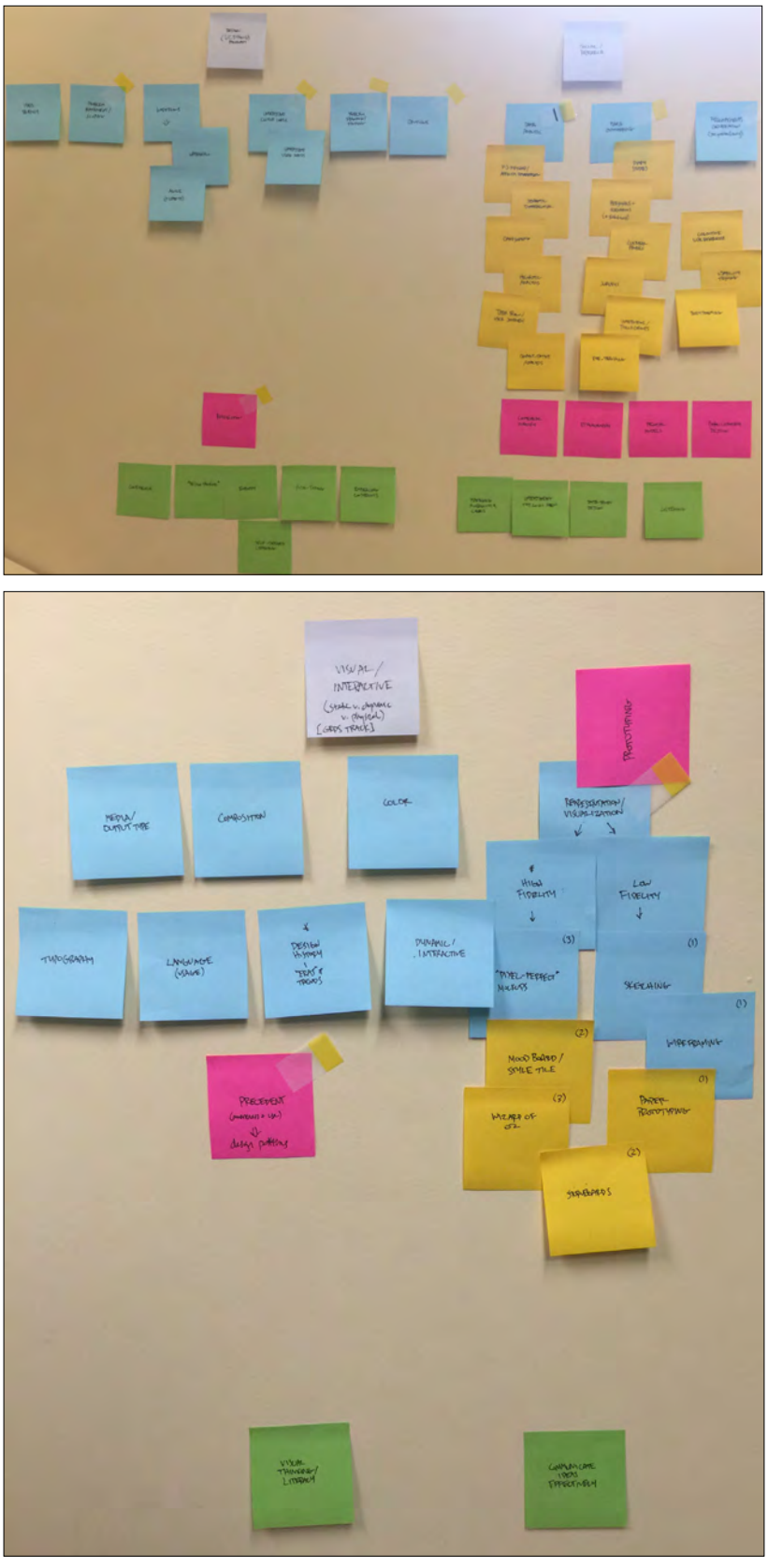

FIGURE 2. An affinity diagram to identify skills (blue), design methods (yellow), meta-methods and approaches (magenta), and hidden learning outcomes (green) to guide our curriculum development.

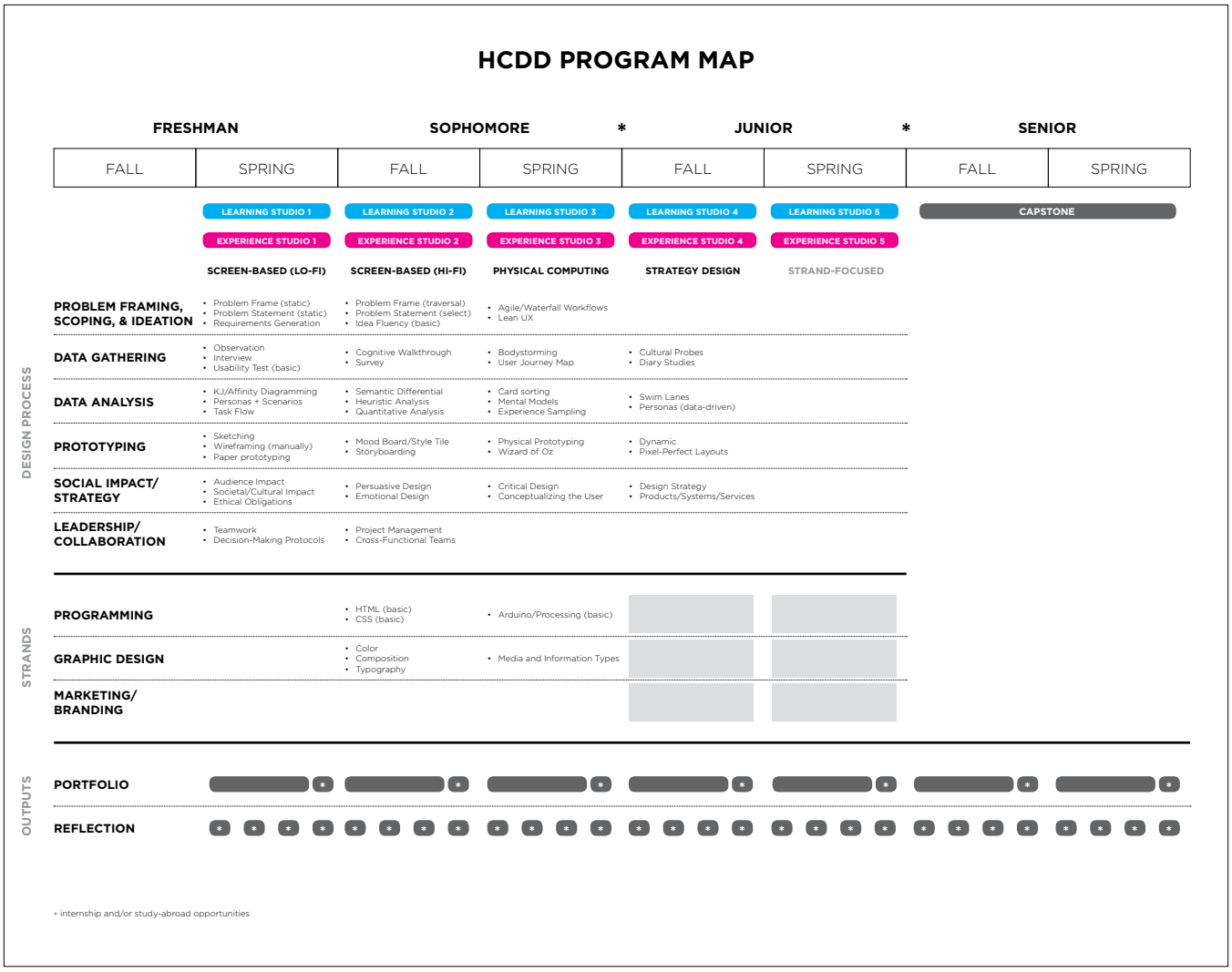

FIGURE 3. Initial program map to document alignment of design methods, specialization strands, and studio themes. Many areas were left incomplete, and this map was abandoned before it was completed. The visual description of the outputs indicating both development and assessment. The long bar in the portfolio row identified continuous development, while the boxes with asterisks indicated some form of formative or summative assessment.

strands in each learning studio?" This sequencing of content and competencies was a monumental challenge, as the original request was for each course syllabus to be completed and available for review at the end of the Fall 2015 semester. Balancing a friendly, relaxed environment with meeting work expectations set by department leadership was occasionally difficult. The team had been tasked to revise the course proposals for all the learning and experience studios and resubmit them through the university approval process. As the semester was progressing and the team was far from revising all the course proposal forms, Mihaela sent a note to the team urging progress. She recognized the note might make a dent in the young team's culture, but, to their credit, the team was able to not only recover but also revise the course proposals with a renewed sense of urgency and submit them on time.

Much of this tension was the result of miscommunication among team members, which took several months to be fully resolved. In retrospect, this was partially a failure on Mihaela's part to communicate work expectations clearly earlier in the semester and reconcile those expectations with how the rest of the team thought the course development process should unfold. This was also a failure of communication on Colin's part, as he intended to build a general understanding of the progression on the program level (Figure 3) and then use the experiences of students in the first semester to decide what aspects did and did not work. This type of just-in-time instructional design was somewhat provocative and risky—and produced some tensions among the team—yet given the time constraints involved, the faculty agreed to forge ahead and trust each other that the plan would work.

Sequencing Learning Outcomes

One of the other big action items in the Fall 2015 semester was the revision of the approved curriculum, adding appropriate learning outcomes and objectives based on the resequencing of the major. This also included altering some of the later approved courses entirely, due to the removal of the web development track.

To do this, Colin identified five major areas that roughly aligned with some of the competency strands identified earlier to scaffold the learning objective construction:

- Problem framing, scoping, and ideation
- Data gathering and analysis
- Prototyping
- Design process
- Design philosophy

These areas were identified based on a review of literature in UX and design, as well as his own research on the identity-formation practices and knowledge of UX practitioners. Notably absent in this list were direct references to global consciousness, entrepreneurship, and technical skills. We had built these into our program in other ways (e.g., by encouraging students to complete an entrepreneurship certificate elsewhere in the college, encouraging the selection of programming electives), but these topics continued to surface in challenging ways as we built out the remaining learning studios.

We used these learning objective "categories" or "strands" to identify appropriate outcomes for each learning studio level (Figure 4). This exercise resulted in a relatively generic progression from basic to advanced across the learning objective "categories." No more details were provided in order to allow for flexibility in future program offerings as the major matured, as well as to acknowledge that several of these courses still needed to be designed in detail. We also wished to define objectives that were relatively abstract, increasing in complexity throughout the sequence of courses, without naming specific methods, tools, or means of assessment.

HCDD STUDIO LEARNING OUTCOMES

	HCDD STUDIO 1	HCDD STUDIO 2	HCDD STUDIO 3	HCDD STUDIO 4	HCDD STUDIO 5
Problem Framing, Scoping, & Ideation	Conduct **basic** analysis of situations, clients and problems, and articulate problem statements. Create concepts that address the issues in the problem statement.	Conduct **intermediate** analysis of situations, clients and problems using **multiple approaches** to problem framing. Create a **variety** of concepts that address the issues in the problem statement.	Conduct **advanced** analysis of situations, clients and problems that demonstrates an **awareness** of organizational strategy. Create a variety of concepts that address the issues in the problem statement and demonstrate **awareness of organizational strategy.**	Conduct **expert** analysis of situations, clients and problems that **aligns** with the client organization's larger strategies and business goals. Create a variety of concepts that **align** with the client organization's strategic goals.	Conduct **expert** analysis of situations, clients and problems to contribute to **advancing** the client organization's strategies and business goals. Create a variety of concepts that **advance** the client organization's strategic goals.
Data Gathering & Analysis	Use **basic** data gathering and analysis techniques to inform design decisions.	Use **intermediate** data gathering and analysis techniques to inform design decisions.	Use **physically based** techniques for data gathering and analysis to inform design decisions.	Use **advanced** data gathering and analysis techniques to inform design decisions.	Use **expert** data gathering and analysis techniques to inform design decisions.
Prototyping	Demonstrate **basic** application of principles of visual and interaction design to create **low-fidelity** prototypes.	Demonstrate **intermediate** application of principles of visual and interaction design to create **high-fidelity** prototypes.	Demonstrate application of **human factors principles** to create **physical** prototypes.	Demonstrate **fluent** application and evaluation of visual and interaction design principles. Use advanced prototyping techniques to create **interactive digital** prototypes.	Demonstrate **advanced** application and evaluation of visual and interaction design principles. Use advanced prototyping techniques to create **working** interactive digital prototypes.
Design process	Explain and apply the fundamental components of user-centered design.	Distinguish among major approaches to user-centered design such as goal-directed design, participatory design, etc.	Distinguish among popular processes and methodologies for UX such as agile, waterfall, lean, etc.	Demonstrate the ability to make recommendations for appropriate major design approaches and methodologies that fit a particular design situation and team.	Demonstrate the ability to lead UX teams through the user-centered design process, employing appropriate approaches, processes and methodologies.
Design philosophy	Articulate the core values of user-centered design.	Compare and contrast the core values of various approaches to user-centered design.	Explain how design philosophy impacts design practice.	Articulate their design identity and personal design philosophy.	Practice user-centered design in concordance with their personal design philosophy.

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FIGURE 4. Alignment of learning outcomes across the learning studios and by category.

Over time, we anticipated that our students would receive formative feedback that enabled their progression towards mastery in each area.

The following learning objectives regarding analysis across the five studios are indicative of our approach:

1. Conduct **basic** analysis of situations, clients and problems, and articulate problem statements. Create concepts that address the issues in the problem statement.
2. Conduct **intermediate** analysis of situations, clients, and problems using **multiple approaches** to problem framing. Create a **variety** of concepts that address the issues in the problem statement.
3. Conduct **advanced** analysis of situations, clients, and problems that demonstrates an **awareness** of organizational strategy. Create a variety of concepts that address the issues in the problem statement.
4. Conduct **expert** analysis of situations, clients, and problems that **aligns** with the client organization's larger strategies and business goals. Create a variety of concepts that **align** with the client organization's strategic goals.
5. Conduct **expert** analysis of situations, clients, and problems to contribute to **advancing** the client organization's strategies and business goals. Create a variety of concepts that **advance** the client organization's strategic goals.

This progression and lack of detail regarding what constituted basic, intermediate, advanced, and expert behavior allowed us to continuously alter the specific methods or activities leading students towards these goals, while also giving us a framework for the students' overall progression towards competence each semester. This amount of instructional flexibility eased our minds, as we focused simply on spiraling the curriculum to increase students' understanding of these areas of knowledge each semester rather than covering an explicit set of content.

Because one of our goals was to address all competency areas each semester, we realized if we asked students to do the same thing every semester, it had the potential to get somewhat boring or repetitive. So, in addition to the spiraling outcomes, we also began to identify how we could provide a "flavor" or theme for what each semester would include. This resulted from a conversation where we discussed students "playing the whole game" (cf., Perkins, 2010; Gray & Siegel, 2013) from the first semester onward. The notion of "playing the whole game" is that component skills must be organized as part of a larger narrative, and that the goal of the instructor is to create and maintain this holism in ways that can be accessed by students. In the context of our studios, we felt that students should never be performing just one part of the design process, but rather always learning and applying concepts in context, linking these tasks to a larger view of design and UX. As a result, we identified a progression from fundamentals to higher-fidelity work to service and cross-channel to strategy to specialization across the studios, thus negotiating a broadening and deepening of the curriculum that always kept the "whole game" in view from the student perspective. In Spring 2017, this progression of themes was solidified in changes to the official course titles as well:

1. Fundamentals
2. Screen
3. Cross-Channel
4. Strategy
5. Specialization

These course titles reflected a natural broadening of UX, from usability-focused work in studio 1 to screen and experientially-focused outcomes in studio 2 to areas beyond the screen that are part of a larger service or system in studio 3. The fourth and fifth semesters were intended to negotiate the UX role within organizations further and deepen personal expertise even further in areas of desired emphasis.

To illustrate how we have implemented this spiral, we present here a set of instructional and conceptual highlights across multiple studios. While we used focus areas or themes to differentiate each course in the sequence beyond "playing the whole game," each course still shared many of the same components: authentic projects, readings, activities, reflection, critique, and portfolio. For each semester, we also introduce other increasingly advanced techniques, even if they did not necessarily "fit" the theme. For instance, HCI history and design history were included every semester, with foundational work on cognitive modeling (e.g., GOMS; cf., Card, Moran, & Newell, 1983) and usability in the first studio, followed up by modern and contemporary HCI theories in the second semester. The differentiation of each course was also shaped by the selection of design methods students would learn each semester. In the first semester, a limited selection of methods such as usability testing, interviews, and observations was chosen; in following semesters, students would learn about participatory and co-design (LS2), Wizard of Oz prototyping and critical design (LS3), and design philosophies in relation to organizational culture (LS4). These ensured a full and foundational "toolkit" for students exiting the program, and also a certain amount of unexpected variety each semester that kept the learning experience fresh and engaging.

The result of these efforts is what we now call the "integrated studio" (Gray, Parsons, & Toombs, in press), which targets student learning from multiple strands and disciplinary perspectives simultaneously.

CENTERING ON STUDENTS' DEVELOPING DESIGN IDENTITY

Hidden Curriculum

In addressing the structure and experience of the program, we attended to not only the explicit experiences indicated by the content we were teaching but also the often-hidden norms and values that relate to the ethical and disciplinary practice of human-centered design. These norms are generally impossible to teach through traditional means, yet Colin knew from his experience conducting an ethnography of HCI education during his doctoral work (Gray, 2014) that the program design could support this development process through careful attention to the "experienced" or "lived" curriculum.

To explicitly design the hidden curriculum of our program, we iteratively identified several characteristic norms and behaviors that we wanted to support. These items were inspired by our previous educational and professional experiences, as well as research on identity formation from Colin. Among these were the following:

- Students should be viewed and treated by faculty as professionals and human beings first
- Students should be judged against the mastery of UX concepts, methods, and tools rather than level-specific acknowledgments of expertise (i.e., being judged as a professional, not as a freshman)
- Students are capable of reading original and seminal texts, and their ability to read complex materials will allow them to continuously self-learn throughout their careers
- Students should see the world as messy, chaotic, and situated rather than scientific, rational, and ordered
- Students should anticipate a designerly role in which they take social responsibility for the experiences that they create
- Students should view failure as a productive and integral part of being a designer and creating new possible futures
- Students need each other to succeed, and the feedback of peers and other students has equal value as that of professors or experts

Building Out Learning Studio 1

The proposal for the first semester of learning studio included a complete lack of technology. This was driven by Colin's experience studying HCI pedagogy during his dissertation (Gray, 2014) and the realization that students needed a level playing ground without having to worry about learning new digital prototyping tools during their first semester. In addition, Colin leveraged scholarship on the value of sketching and the different cognitive processes involved in physical versus digital manipulation that had been previously found to be important in designer expertise development. The decision to not use digital tools was potentially contentious in a department of computer graphics technology, so Colin built grassroots support and sought advice—and by extension, buy-in—from other faculty before finalizing this constraint for the first learning studio.

In addition, Colin began to identify the activities and seminal readings for the first semester, using pieces of sticky notes to map them out over a grid of the semester's meeting dates (Figure 5) as inspired by collaborative work on sketching with Elizabeth Boling (Boling & Gray, 2015). This was a complex and messy process, which involved not only the selection of relevant readings, but also their sequencing in relation to the other strands of the integrated studio. Colin and Austin had previously taken graduate readings courses in HCI, but there was no clear way to map a standalone readings course onto a five-semester studio sequence that also supported in-context and project-based learning.

FIGURE 5. Planning documents for Learning Studio 1, with Post-Its and flags containing ideas for readings, activities, or critique sessions

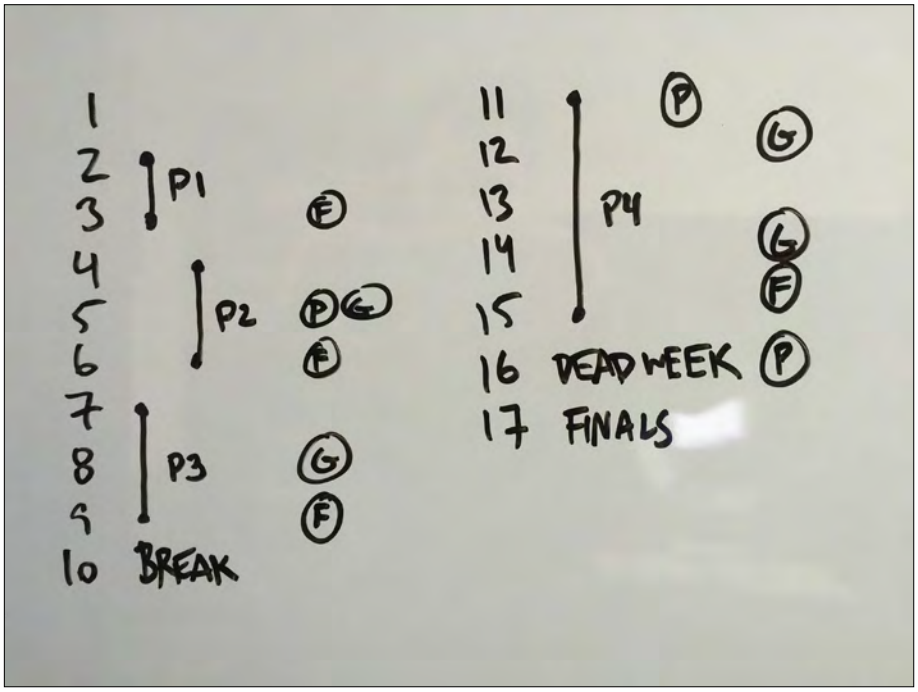

FIGURE 6. Rough sketch of the main course projects and instructional activities for Learning Studio 1. P1-P4 indicates project duration, while [F] indicates final presentations, [G] indicates group critique, and [P] indicates a portfolio session.

Many ideas were discarded entirely, moved into later semesters (see the program map for some of this process; Figure 3), or reimagined in relation to project briefs. This constant generative tension among projects, readings, course activities, design methods, and sequencing required iteration over multiple weeks. Some decisions, such as the core methods to teach in the first semester, came relatively quickly, while other decisions, such as how to integrate HCI and technology history, were left in limbo almost until the respective course began.

In addition to these planning sessions that were focused on content, Colin also wanted to ensure that the learning environment *felt* like a studio. One of the most memorable and central components of studio learning is critique (or "the *crit*"; Parnell, Doidge, & Parsons, 2012)—a

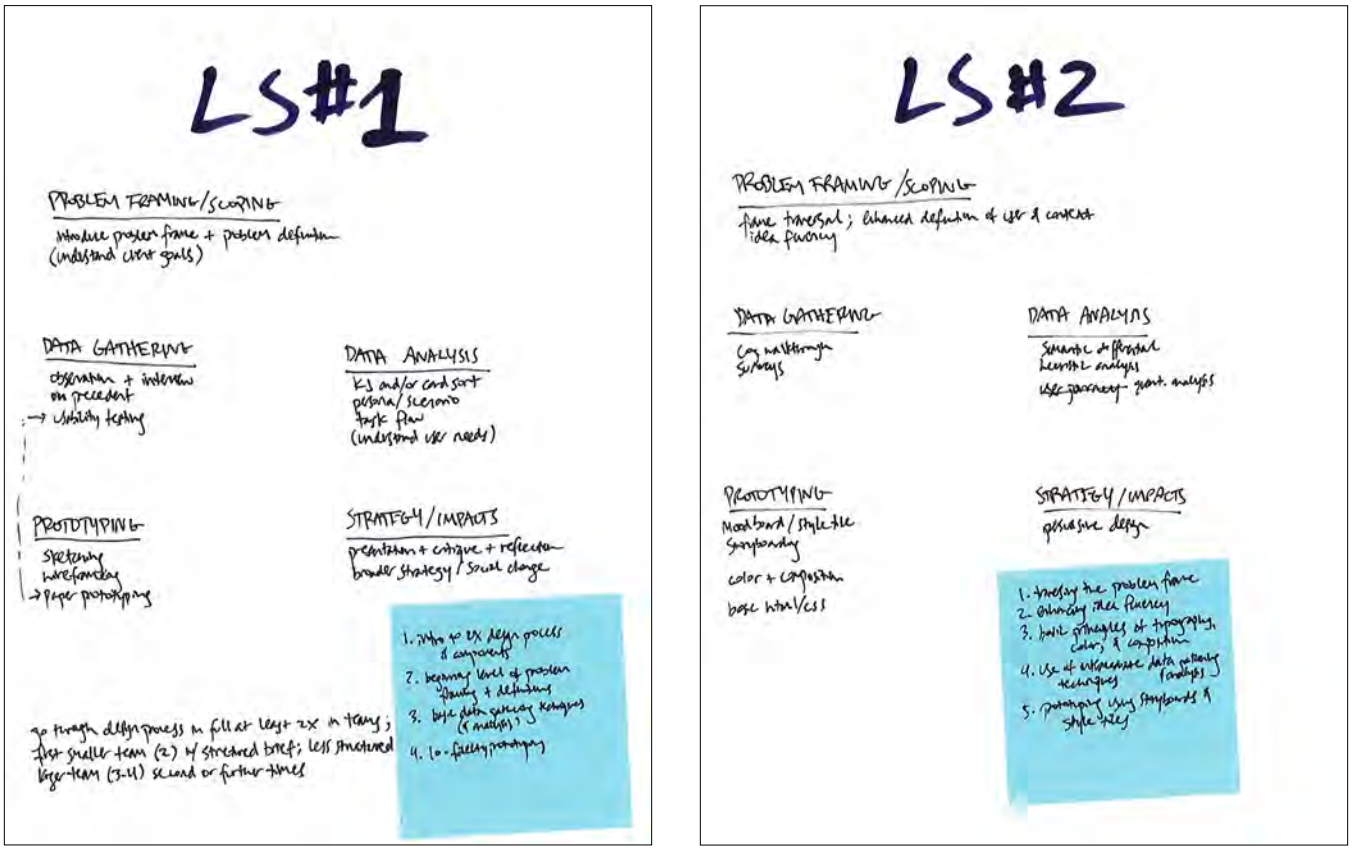

FIGURE 7. Low-fidelity prototype of the instructional goals and outcomes for each learning studio. While the same five categories remained stable across studios, the list of methods varied and built upon the previous semester. The blue Post-It note indicated potential learning outcomes

space for social, generative, and designerly communication surrounding the creation and evaluation of design artifacts and processes. To diagram how critique experiences would relate to the overall progression of projects, Colin created a rough sketch (Figure 6) that mapped out project duration by week, with an indication of different types of critique across those projects. This process ensured that students would have quick enculturation into critique practices and that these critique sessions would provide value across each project lifecycle.

In conjunction with the development of these more specific course sequences and arrangements of materials and resources for the first studio, Colin was also encouraged to think about the entire sequence of studios and the threads of experience that would weave through each. While he began this process by organizing materials in relation to the program journey map, the digital approach quickly became difficult to manage. Cognitively, Colin felt overwhelmed by the sheer number of variables, and as a result, turned again to paper and physical prototyping.

What resulted was a simple letter-sized sheet of paper for each learning studio (1-5; Figure 7). On each sheet, Colin identified the methods or concepts that would be taught to fulfill each learning objective/competency strand, with easy comparison to other semesters. With all of these sheets of paper out on the table, it was much easier to see the relationship among methods, the scaffolding needed to introduce certain methods in later semesters, and the overall holistic experience(s) that we could expect students to have. While these sheets were created only by Colin, they were later used in team meetings to inform the wording of learning outcomes and to situate the methods each studio would include.

After imagining some of the methods that students would experience in each semester, Colin used a blue Post-It to document other more intangible parts of the learning experience and studio sequence, such as the types of prototyping that were anticipated (e.g., lo-fi with paper, use of storyboards), process moves that students would be expected to make (e.g., traversing the problem frame, building idea fluency), and other conceptual knowledge that was not easily distilled into methods (e.g., color theory).

"MAKING IT WORK": SPRING 2016

Although we collectively had a semester to prepare, Spring 2016 came more quickly than we would have liked. While the curriculum changes we had proposed were now in review at the college level, we still had many challenges in piecing together the curriculum for the first learning studio, and we had no equivalent of the multiple cohorts needed for the final experience design. In addition, due to the late approval of the major, we had only one "true" UX student enrolled in the major that would be with us in learning and experience studio. So, we sought to "make it work" given the resources and students that we had access to. Learning studio 1 met for two hours, twice a week, while experience studio met for 2 hours, three times a week.

Experience studio included 21 students, most of whom had taken only one course in UX (CGT 256-00; a course for non-majors on UX fundamentals that had been taught for multiple years). Many of these students were not part of the new UX program and were not taking the learning studio sequence, as was intended in the program design. This led to a fragmentation from the start, where students were not equally enrolled in both learning experiences, as was the intention of the program design. While we weren't happy about this fragmentation, we had to start the studios off in this form to build toward the multi-year program design we had envisioned.

The 21 students enrolled in the experience studio worked in teams of three on seven projects in the first semester. Meanwhile, Learning Studio 1 enrolled 18 students, only one of whom was declared in the major at the time. Only one of these students had previously taken CGT 256-00 and had some basic knowledge of UX design.

Learning Just-in-Time

As part of the course design in both studios, students had to learn about concepts, theories, and methods on-the-fly. While in the experience studios, this progression of just-in-time (JIT) learning was foregrounded through industry project requirements, the JIT needs in learning studio were specifically engineered and sequenced to encourage specific kinds of designerly development.

One example of this progression of JIT learning was in the first two-week project in learning studio 1. Students were given an impossible, ill-structured problem to solve: they were asked to alter the mental model of FitBit users, addressing problems of cheating or fabricating exercise data while also taking into consideration larger social, cultural, and organizational forces that encourage these cheating behaviors. In only a week, students were expected to interview users, create paper prototypes, and usability test these prototypes with users. No students had these skills when they started the course. Thus each process move required students to engage in self-learning or participate in activities in class that encouraged this learning (Figure 8). Our conjecture, backed by research and previous teaching experiences, was that—when confronted with a wicked problem—students will never reach a conclusion, even given the most robust and sequenced scaffolding. Rather, we chose to "throw" the students into the "deep end"—what Schön (1983) calls the "swamp"—and then teach them to swim in the midst of complexity and chaos.

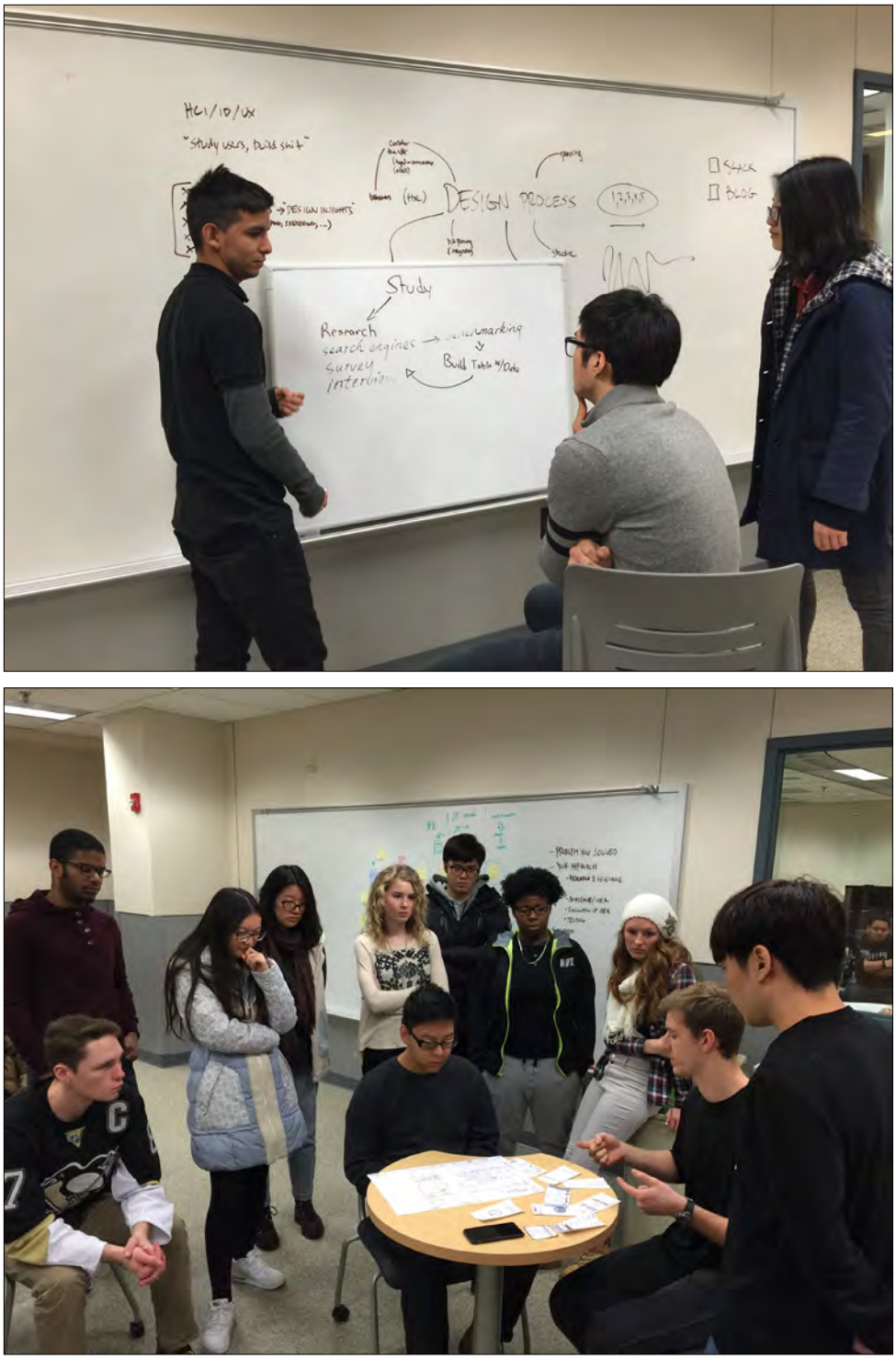

FIGURE 8. Students in Learning Studio 1 were engaging in discussion of design processes (top) and performing their first usability test just-in-time (bottom).

This approach required not only carefully sequencing of the JIT resources that would be needed, but also providing emotional and social support as students' coping mechanisms for tracking their success became inadequate. Because we encouraged students to jump in, try, and fail, metrics of success such as "A's" for most of our students no longer were a good indicator of their actual learning and development. Thus, through this process of learning to engage in complexity on its own terms, students were also learning to take control of their own education and to recognize that the scientism that had pervaded most of their secondary education would not help them succeed or thrive in a design context. When designing possible futures, no amount of deductive logic, rational thinking, or application of the scientific method would *guarantee* a positive outcome. Thus, our approach to learning through failure and engaging with JIT learning throughout each project —scaffolding students to confront failure rather than avoid it—enabled the formation of a design identity that was characterized by situated rationality/logic and lived experience rather than only scientific forms of rationality. The use of four projects during the first semester stretched students to their limits, engaging them in different formulations of ill-structured problems in a variety of contexts, most of which were unfamiliar and required deep investigation. After the first two cycles of project work, engagement in various elements of the design process became more natural, and the idea of failure became an expectation rather than something that could be prevented.

Critiques and studio time to support design work were also integral to this just-in-time approach (Figure 9), with regular provision of feedback through group crits, where students presented their work and solicited comments from their peers and the instructor. We also provided regular opportunities for work in class, where the instructor could provide less structured feedback and observe teams at work.

Building a UX Community

As students learned, failed, and reflected together, the seeds of a community began to take form. We required students to submit a weekly reflection on a collective WordPress course blog, building on Colin's previous reflection research (e.g., Gray & Siegel, 2014). In conjunction with the demands of the classroom environment, this blog became a safe space for students to project their individual identity, both about the course and about life in general. These reflections built a level of trust among students that quickly allowed them to function as a community. We saw this as an opportunity to build even deeper community roots in the program at large, and we began to make plans to introduce a mentoring program in Fall 2016, not only pairing advanced and beginner students, but also faculty and students together in supportive relationships. This program has since expanded even further, with all transfer or newly admitted students being assigned a volunteer mentor that is a year ahead of them in the program. This connection allows students to acculturate quickly, build professional connections, and envision their own future as a professional through the eyes and experiences of a student a year ahead of them. In addition, the faculty mentoring program has facilitated social relationships among faculty and students that foreground care, trust, and partnership. These parts of the experience are outside of the classroom but facilitate identity formation and community just as much as the formal studio experiences.

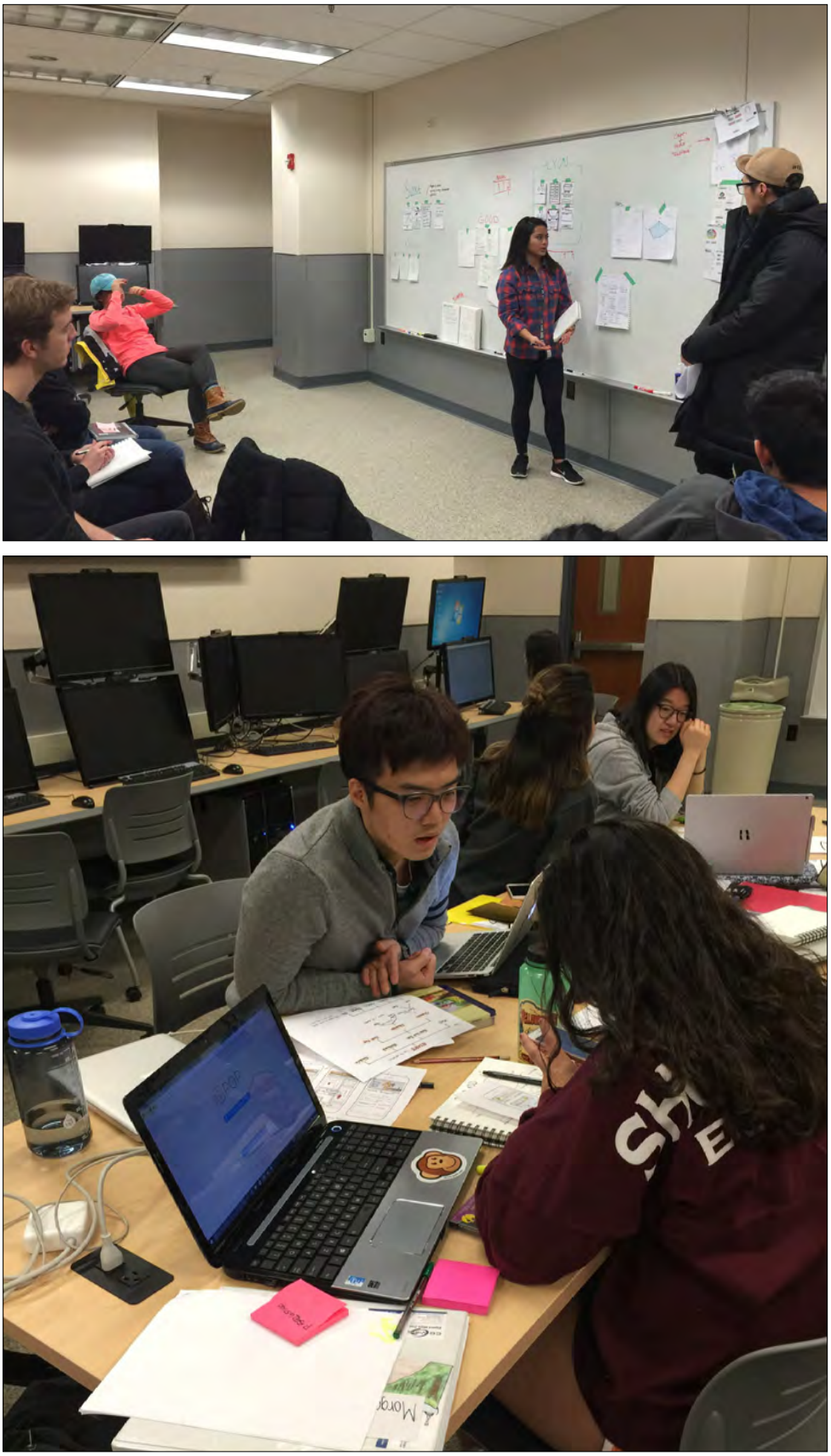

FIGURE 9. A student team was presenting their in-progress work during a group critique (top), and a design team at work during studio time (bottom).

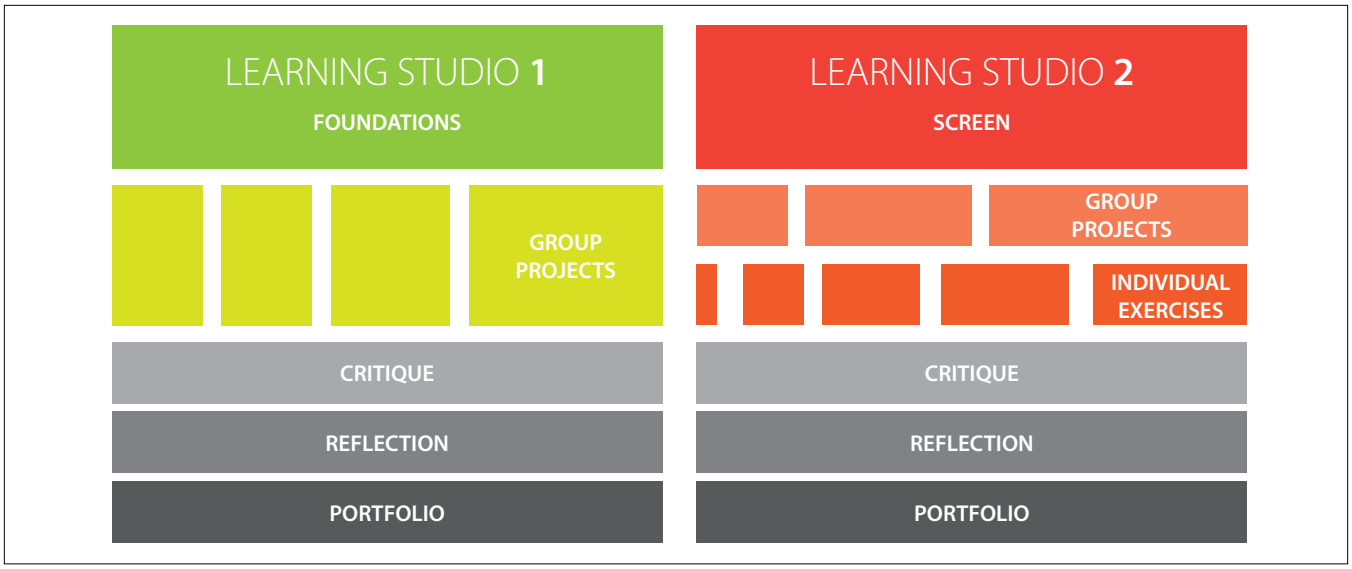

FIGURE 10. Comparison between group-only projects in Learning Studio 1 and group and individual work in Learning Studio 2 and beyond. This shows the stability of the spiral approach, while also introducing new structural elements following the first semester.

Ongoing Curriculum Development

As another dimension of the development of a cohesive UX community, students were aware that the UX faculty were engaged in studying the program and refining the course offerings over time. We presented the studios as a "living laboratory" in the model of a lab school, and the students were consented each semester as part of a longitudinal study on the program development. Thus, students were acutely aware that we were "designing their experience" with intentionality, using the same skills and methods that we were teaching them. This transition took a couple of months, as students got past the awkward reality of them being subjects of research (which was unfamiliar for them), they embraced this element as a partnership. Some students went as far as to partner with Colin on research projects relating to UX pedagogy as a way of delving further into the program design and future directions.

Challenges and Failures

Of course, in spite of many successes in the first year, there were many tensions and outright failures. In the two studios, we had a lack of alignment of students, resulting in disjointed and fragmented experiences and a lack of consistent methods/process knowledge. While the student experiences were meaningful, we acknowledge several areas as a faculty where we anticipated—and realized—utter failure.

Across the two studio strands, we simply had too many tools for communication. In learning studio, we used a hosted WordPress site for a reflection blog, an individual WordPress.com site for each student to build their portfolio, a Slack workspace for each course environment, and other tools for resource sharing (e.g., Padlet, OneNote, Google Drive). It was clear that we needed to streamline and be more intentional about how we integrated technologies into the program experience to show how the studios were integrated with each other. For instance, while the portfolio and reflections were technically shared across learning and experience studio, students often did not recognize this overlap when they reflected or updated their portfolio. Additionally, this lack of integration impacted the students' ability to see proper exemplars and model their work and reflective ability off of more senior colleagues.

In addition, since we did not yet have vertical integration of students, the ways in which projects were run in experience studio (with the goal of combining multiple skill levels on each project) were not yet feasible. This left our starting students, who have often called themselves the "lost generation," with an increased burden of both helping to define the program and its direction alongside us UX faculty, as well as *creating* the benchmarks for future success which they never had as part of their own experience. Out of the original cohort, six took all courses, but only two were able to identify as UX Design majors. The remaining students from the original learning studio and experience studio cohorts exited the program early, due to requirements of their majors, graduation timelines, lack of electives to take more UX courses or interest. This fragmentation also impacted our ability to engage in rich and meaningful mentoring experiences, particularly for the first students in the major.

THE INTERVENING STUDIOS (II-V)

In the studios that followed learning studio 1, we took on many new UX Design majors: 20 in the 2017 cohort, 25 in the 2018 cohort, and 35 in the 2019 cohort. As these new students augmented our experience studio and brought us closer to the multi-level, designed learning experience, we

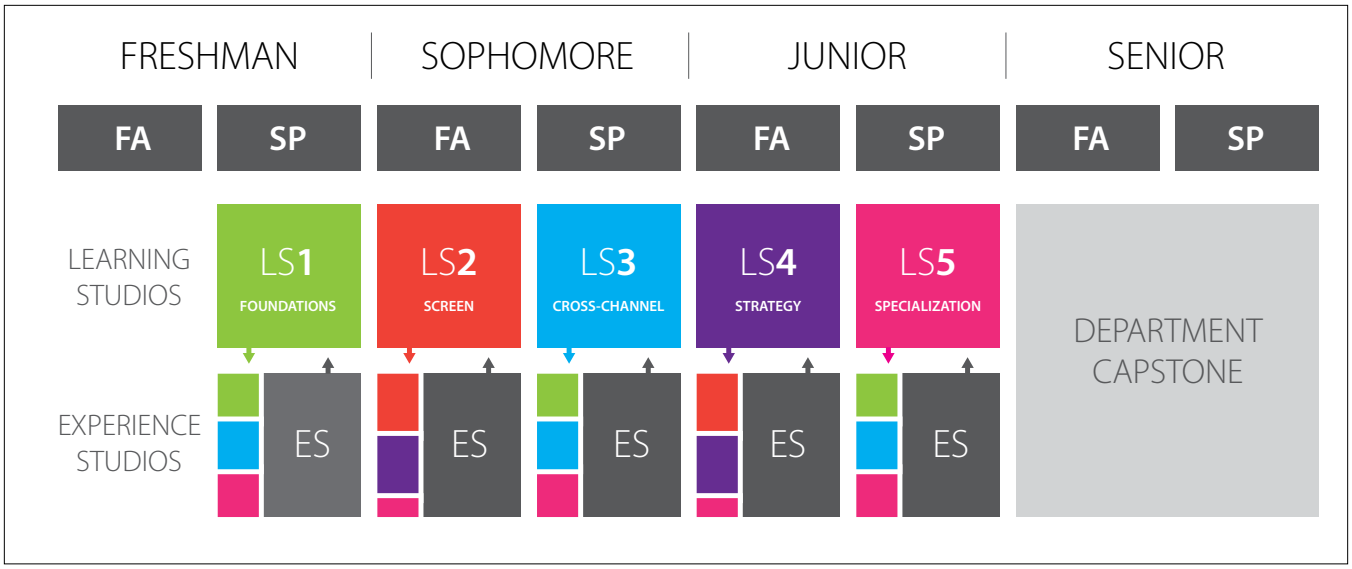

FIGURE 11. Final program-level course flow. Colors indicate populations of Experience Studio each semester, with optional participation by seniors who have already completed the 5-semester studio sequence.

also continued to develop and teach our more advanced learning studios (see program map in Figure 11).

As the spiral continued in LS2, students were increasingly made aware of the breadth of UX design, participating in both group projects and individual exercises (Figure 10). Group projects continued to build their collaborative capabilities and allowed them to share skills and interests in the service of a larger design aim, while individual exercises were intended to build foundational capacity in web programming, heuristic analysis, and other essential skills. During this studio, students learned to balance individual deadlines for exercises alongside their group project work, although group projects remained the core of the studio experience.

This pattern continued in LS3, with the development of student expertise in physical computing and design "beyond the screen." Individual exercises ensured students' abilities in basic Processing and Arduino programming, while group projects enabled students to think about physical computing and prototyping in relation to larger systems and services. The first offering of LS3 was taught by Paul. The course was slightly different from the previous learning studios in that more advanced technical skills were required. While the fundamental themes of user research, prototyping, and testing were still a core part of the experience, students were to make use of physical computing devices (e.g., Arduino) and emerging mixed reality devices (e.g., Microsoft HoloLens). Most students were somewhat anxious about the course, partly due to their lack of strong technical skills. However, because Paul had taught all but one of the students the previous semester in LS2 (co-taught with Colin), there was a bond that helped the students trust that they would not be expected to perform beyond their capacity. The technical aspects of the courses ended up being quite challenging, as most students lacked basic programming proficiency. Paul had to offer extra sessions to teach students the basic skills that he had assumed they would have coming into the course. When the studio was designed, the team had assumed that students would take a basic web development course where they would gain sufficient knowledge, but not all students elected to take this course, and even some who did take the course lacked enough expertise to build basic web pages confidently. The students ended up performing well in the end, but we are still determining how to best scaffold the development of technical skills throughout the sequence of courses.

In LS4, students focused their skill development on the application of UX skills to industry contexts, realizing the utility of UX in relation to product/process lifecycles such as waterfall, agile, and Lean UX, and the need to communicate UX value to stakeholders at various levels of management. This portion of the studio sequence was designed and taught by Austin in his first semester after joining the program. For him, it was difficult to identify reading materials and assignment sequences that would align with what the students already knew at that point in their progression, since he had not been involved in the design and development of the curricular experience. As a result, the students were even more explicitly placed in an "experimental" learning setting, where they were aware that their voice in how Studio 4 was taught and progressed would be a valuable asset in the evolution of the program. The first iteration of Studio 4 was taught using individual, semester-long projects, hoping to fill in a pedagogical gap for the students, who had primarily engaged in group work up to this point. However, this strategy did *not* align well with the goals for that studio regarding exposing students to a variety of team management methodologies. As a result, the second iteration of this studio has been

revised to include group work, but in a few innovative ways. The first project tasks the students with building a problem space and prompt, which is passed on to a separate team as that team's second project for the studio. In this way, the students are able to act as both clients and designers, and experience how to interpret others' design documentation. The third project in this studio is designed as a large-scale collaborative project in which the entire class, including the instructor, work on building out their ideas for a prompt and collaborative decide how to separate out into smaller, agile teams to work together in the most efficient way possible.

Finally, the sequence of courses ended in Spring 2018 with the first offering of LS5, which served as a specialization opportunity. UX students had been encouraged throughout their program to build a breadth of skills as a generalist, while also specializing in one or more specific areas. For instance, students might establish deep expertise in user research, voice user interfaces (VUIs), or automotive UX. In this final semester, students were challenged to build their own syllabus, complete with readings, milestones, and project outcomes, on which they would be assessed in formative and summative ways. In addition, students worked in teams for two design challenges during the semester.

Of the 18 students that began with us as our first cohort in LS1, 13 remained in LS2, 13 in LS3, 8 in LS4, and 6 in LS5. Of the 6 students in LS5, two were officially enrolled in the UX major, and one of these students graduated in December 2018. The non-majors identified themselves as UX-focused and took as many studios as they could prior to graduating with another major. Over time, these students have built their own expertise as UX designers, participated in internships, served as peer mentors, and have been active participants in the development of the program.

REFLECTING ON USER EXPERIENCE-DRIVEN INSTRUCTIONAL DESIGN, FIVE SEMESTERS LATER

In plotting our learning experience, we ended up engaging with more UX principles than we did ID principles. In fact, many moments in the program that serve as gateways or thresholds to further learning are, in fact, against ID orthodoxy. (E.g., failing everyone on their first project rather than providing appropriate scaffolding; teaching and assessing component skills before having students use those skills together in a synthetic way; providing "wicked" rather than tame problems to begin the learning experience). What could be viewed as a program or series of courses without sufficient scaffolding, is, in our design, critical to allowing students to *unlearn* and *relearn* what it means to engage in design work, facilitating growth in creativity, empathy, and stimulation of their own developing professional judgment.

CONCLUSION

In this design case, we have described the creation of a comprehensive undergraduate program in user-experience design that engages students in two strands of studios. Through these studios, we have intended for students to build both theoretical and practical skills that will enable their success in industry, both now and well into the future. While we have experienced numerous challenges during the development of this program, our focus on the holistic learner experience has allowed us to minimize the focus on content, and rather maximize the development of design identity, expertise, and agency.

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