Designing the Future of Experiential Learning Environments for a Post-COVID World: A Preliminary Case Study

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ABSTRACT

Experiential learning environments such as computer labs and design studios are critical for learning hands-on skills like programming, design, and data science. However, during and even after a global pandemic many people will not be willing to congregate in such high-density physical spaces due to safety concerns. How can we design experiential learning environments of the future to make them broadly accessible regardless of whether students can be physically present? To spur discussion about this question, we performed a preliminary case study where we compared in-person and online versions of software-based design courses created before and during the early-2020 COVID pandemic, respectively. We found that online tools such as videoconferencing, chat, and screensharing worked better than their in-person counterparts for certain user needs, but they cannot foster as much ambient awareness or spontaneous interaction. We then offer design recommendations for how to improve remote learning tools to potentially match or exceed face-to-face interactions. We hope our work can inspire discussion at this symposium about how we can design better learning environments to prepare people for the new future of work in a post-COVID world.

Author Keywords

remote learning technologies; experiential learning

INTRODUCTION

To prepare for the future of work in uncertain economic times ahead, people of all ages can benefit from *experiential learning environments* [4] where they get hands-on practice and feedback to learn skills such as programming, web design, data science, and UI/UX prototyping. Figure 1 shows examples of computer labs, design studios, and live critique sessions where such experiential learning often occurs. These are intimate venues where people work, critique, and debate in close physical proximity. Unfortunately, these venues can no longer exist while COVID remains a threat, and even in a post-COVID world many may still not want to return to these high-density environments due to physical and mental health concerns.

Figure 1. Experiential learning environments in lab and studio settings.

Experiential learning is critical for preparing people of all ages for the new future of work, ranging from university students to those looking to change fields to mid-career professionals supplementing existing skill sets. Thus, making this form of learning available to as many people as possible will be essential for improving economic opportunities and equity in the coming decades. ***How can we design experiential learning environments of the future to make them broadly accessible regardless of whether students can be physically present?***

To begin addressing this question, we performed a case study of pairs of interactive software design courses at our university that were created before and during the COVID pandemic of early 2020. The 'before' versions were in-person courses with classrooms like those of Figure 1; the versions created in Spring 2020 during the pandemic were online-only. We compared three kinds of experiential learning environments across in-person and online versions of identical courses: 1) design studio critique sessions, 2) TA-guided interactive lab activities, and 3) open lab hours where TAs give real-time technical help. Our goal was to analyze the pros and cons of each format (in-person vs. online) to inspire the design of future learning environments that can combine their respective advantages.

NFW '20 (Symposium on the New Future of Work), August 3–5, 2020, Virtual Event.

Need	In-Person Courses	Online Version of Same Courses	Design Recommendations
Comfort/ privacy	☹packed into a dense physical space ☺can lurk in back of classroom	☺participate from one's own home ☺text chat more private than video	animated virtual avatars, semi-anonymous text chat
Feedback	☹dominated by a few outspoken people ☺easier to have quiet side conversations	☺text chat fosters more feedback ☹harder to have side conversations	add presenter role & whisper mode to videoconferencing
Shared context	☺multiple channels of context in-person ☹may get distracted by sensory overload	☹screen-sharing can feel restrictive ☺shared screen encourages focus	better multi-screen sharing, phones as secondary displays
Ambient awareness	☺can hear background chatter ☺TA can walk around to "read the room"	☹cannot hear background chatter ☹Zoom breakout rooms feel isolating	2-D location-oriented videoconferencing system
Flexibility	☹need to congregate in physical space ☹studio classrooms are shared resource	☺more flexible scheduling ☺no contention for classroom space	merge async with sync tools, facilitate TA multitasking

Table 1. The benefits (happy face ☺) and drawbacks (sad face ☹) of in-person versus online versions of experiential learning courses in our case study.

Table 1 summarizes the findings and design recommendations from our preliminary study. These recommendations point toward improving specific remote technologies, but we conclude by discussing more general sociotechnical issues such as setting human expectations for the new normal of learning in a post-COVID world, designing for greater inclusion, and aspiring to surpass the fidelity of physical environments. Our paper strives to spark discussion at this symposium about how we can design experiential learning environments to prepare people for the new future of work in a post-COVID world.

BACKGROUND AND PRIOR WORK

The two classic CSCW papers that best contextualize our work are *Beyond Being There* [2] and *Distance Matters* [9], both published roughly 25 years ago. Beyond Being There encourages designers to create remote work technologies that take unique advantage of computational capabilities (e.g., anonymity, asynchrony) to surpass face-to-face interactions rather than merely trying to imitate face-to-face. Distance Matters similarly argues that, despite advances in technology, it will still be hard to replicate the fidelity of face-to-face interactions, especially for transferring tacit knowledge via nonverbal cues. It suggests that one successful strategy for remote collaboration is to *reconfigure* the collaborative work to cope with limitations of current technology. Our study extends the scope of these classic ideas to supporting education in the modern time of global pandemics, with an emphasis on experiential learning [4] and studio-based design education [3]. Our findings and recommendations (Table 1) point toward potential ways to surpass face-to-face interactions when learning remotely.

The other main category of research that relates to ours comprises remote learning tools spurred by the ascendance of MOOCs (Massive Open Online Courses) over the past decade [5]. Traditional lecture-homework-exam courses have been easier to port to a MOOC format, but those involving creative design activities and synchronous discussions have been harder to bring online. Researchers have deployed prototype tools to MOOCs and large university classes to scale up such interactions. For instance, asynchronous tools such as PeerStudio [7] and CritiqueKit [8] provide lightweight structured rubrics to encourage high-quality peer feedback for open-ended design and writing activities. Synchronous tools such as Talkabout [6] foster diverse real-time group discussions and Codeopticon [1] let a tutor help multiple students at once. Our study points toward designing new tools along these lines for both MOOCs and in-person courses. We predict that in a post-COVID world, in-person and online courses will blend together as people become less comfortable with packing into dense physical spaces such as instructional labs and studios.

METHODS

We performed a case study comparing in-person and remote offerings of two university courses with significant experiential learning components: Course A was an interactive software design course where teams of students underwent a user-centered design process to create web applications for specific clients; Course B was a lab-based course where students learned a variety of computational tools on Unix-based platforms. The first author has been an undergraduate tutor for both courses for three years. (Undergrads at our university serve as tutors for multiple courses at once as part of a peer tutor program.)

Both courses were taught in-person earlier in the 2019–2020 academic year, taking place in physical lab and studio spaces similar to Figure 1. When our university shut down due to COVID in March 2020, both courses rapidly transitioned to an online format for the Spring 2020 quarter (April to June).[1] The online versions used Zoom for videoconferencing to hold virtual lab/studio sessions and Piazza as the discussion forum.

The first author took field notes from being a participant-observer working as a tutor (a.k.a. undergrad TA) in three kinds of experiential learning environments in these courses:

- *Design studio critique sessions* (Course A): Weekly sessions where project teams presented their design prototypes for feedback from classmates and staff.

[1] Since we are on an academic quarter system, we could observe fully-online courses that began in April 2020 during COVID; we compared them to in-person offerings of those same courses pre-COVID.

- *TA-guided interactive lab activities* (Course B): Students work through guided activities in the lab to learn Unix-based tools with tutors around to assist as needed.
- *Open lab hours where TAs give real-time technical help* (Courses A and B): Students work on their projects in the lab/studio space and tutors are around to assist if needed.

The first author had already been taking informal field notes for the in-person offerings of Courses A and B as formative data (not yet published), so when COVID quarantines started, we saw an opportunity to do the same for the now-online offerings of both courses. Thus, we now have field notes from paired in-person and online versions of both Courses A and B.

Together with the second author (who was not involved in teaching either course), we iteratively categorized these field notes into higher-level themes using an inductive analysis approach. We distilled five main student needs (summarized in Table 1) along with comparisons of in-person and online mechanisms; this approach roughly follows the framework of *needs, media, and mechanisms* from *Beyond Being There* [2].

Limitations: Due to the lack of preparation time when COVID struck, these case studies are more informal than what would be expected for a full conference or journal paper. As a participant-observer, the first author saw only the students in labs and studios during her shifts. We believe our preliminary data can spark engaging discussion at this symposium, though.

Also, we did not study the many aspects of these courses outside of lab/studio settings, such as lectures, exams, grading, and other logistics. Finally, these courses are software-based so some of our findings may not generalize to physical-based design courses (e.g., architecture, industrial design).

MAIN FINDINGS AND DESIGN RECOMMENDATIONS

We distilled five major themes (summarized in Table 1) from our observations of experiential learning environments in both in-person and online versions of the two courses we studied. Based on these findings, we offer a set of design recommendations to enable tools to combine the benefits of both formats.

Comfort and Privacy

First and foremost, students must feel comfortable in the learning environment or else they will not actively participate.

In-person: Since everyone is packed into a dense space (Figure 1), some students may feel uncomfortable for physical reasons or self-conscious that many eyes are on them. If they walk into class late or need to step out momentarily, that also feels awkward. But one advantage of a physical space is that one can lurk in the periphery (e.g., back of the room), whereas everyone is equally visible online in a Zoom videoconference.

Online: In general, online is better than in-person for comfort. Students can participate in Zoom from their own home (assuming they have a private space). They can turn webcams off for greater privacy and also chime in via text chat, which can be more comfortable than speaking via voice. Students are also more willing to ask for help online (both synchronously and asynchronously) since they can do so semi-privately.

Recommendations: To improve comfort and privacy, videoconferencing tools could support animated avatars such as Apple's Memojis in iOS (example below), which animates a cartoon face in real time based on the student's facial expressions that their webcam continually detects. Students may feel more comfortable projecting an avatar than their real faces and home backgrounds. It would also drastically cut down on bandwidth needs versus sharing dozens of video feeds in Zoom. Videoconferencing could also support anonymous text chat as a side channel for students who want to participate anonymously. To prevent misuse, instructors should still be able to see everyone's real identities and delete inappropriate chats.

Feedback

As Figure 1 shows, giving and receiving feedback on works-in-progress (e.g., sketches, UI designs, software prototypes) is a central activity in experiential learning environments.

In-person: In theory, physical presence gives richer affordances for live feedback [9], but in practice we observed that usually a small number of outspoken individuals dominate the conversations, which made the rest of the class disengage. But one advantage of in-person is that students can quietly whisper to one another and have side conversations before deciding to bring up their ideas publicly in front of the entire class.

Online: Students gave much more feedback online than in-person since they could easily send text chats while their classmates were presenting their work via screenshare. The main benefit of text chatting is that it does not feel like it is interrupting the flow of the presenter; also, other students can chime in with +1's, emojis, or follow-up comments. The downside is that it is harder to have side conversations; there is no analogue of quietly whispering to your neighbor.

Recommendations: Videoconferencing could add a "presenter" role to assign to the student (or group of students) currently presenting their work, as indicated by who is sharing their computer screens. That way, classmates can directly text chat with the presenter(s) to give them private feedback without everyone else in class seeing it. For students who prefer to give richer audiovisual feedback, the tool can allow them to leave short voice messages for presenters alongside an annotated video snippet of part of their screenshare recording. To support "whisper mode" it could let students chat privately to classmates without instructors seeing those chats; but we need a way for instructors to prevent this feature from being abused.

Shared Context

When an instructor sits down to help a student one-on-one or when students are working together in class, it is important for them to have shared context to mediate those interactions.

In-person: As shown in *Distance Matters* [9], in-person provides multiple rich channels of shared context since everyone can see the same computer screen, point to it, hand-draw on paper or the whiteboard, inspect other physical artifacts, and get implicit cues by reading everyone else's faces and gestures.

Online: Although online is generally inferior to in-person here, one benefit is that it forces everyone to look at the same shared screen (e.g., with Zoom screen-sharing) and annotate it with a virtual pen tool. This enforced focus may prevent certain students from getting distracted by having too many different stimuli to focus on in-person (e.g., other people's faces, laptops, hand-drawn sketches, loud voices in the background).

Recommendations: Enhance screen-sharing features in video-conferencing tools to quickly let users switch between multiple display types, such as their laptop screen, a webcam pointed at a physical artifact, and a tablet for hand-drawn sketches. Since many people have smartphones, that could be used as a secondary shared display to provide more context; they can use touch gestures to make deictic references to shared elements.

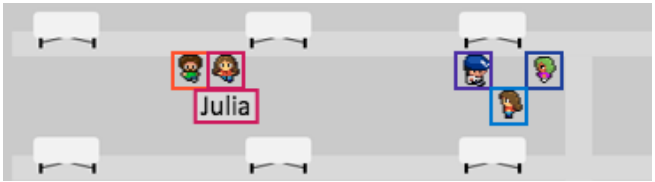
Ambient Awareness

Experiential learning environments are often energetic and loud during freeform work times, with students working on their projects in an open space and instructors walking around to provide on-demand feedback to individuals or small groups.

In-person: The main advantage of in-person is that students and instructors have better ambient awareness of their surroundings even when engaged in a conversation; they can still hear what is going on in the background or pause if something notable happens. For instance, if a TA (teaching assistant) is helping a student on a particular design problem, a neighboring student might overhear the conversation and walk over to participate as well. TAs can also take the pulse of a room by walking around the physical space and glancing to get a sense of how students are doing, which is harder to do online.

Online: In our experience it is very hard to replicate this kind of spontaneity and ambient awareness online because videoconferencing tools are designed to only hold one focused conversation at once. If multiple people are talking at once, it is impossible to discern what is going on. Zoom has breakout rooms where students and instructors can split off into small private groups; but breakout rooms are too isolating and do not let participants see or hear what is going on in other rooms.

Recommendations: Rather than using standard videoconferencing tools, one idea is to create a location-oriented interface where each person is a virtual avatar who can move around in a 2-D map that looks like a studio classroom. Just like in the physical world, they can see and hear only people who are near them in the virtual map. Online Town (`https://theonline.town/`) is a videoconferencing tool that supports this type of map-based interaction:



In the above screenshot, there are five people in a virtual classroom. The two people on the left can see only each other's live webcam feeds (like they are in a temporary Zoom breakout room), as can the three on the right. At any time, they can move around to form other impromptu groups and see/hear only those who are closest to them. This fluid interface lets students work either independently or in small groups, then lets instructors "roam" around the virtual classroom to see what everyone is working on. However, it still cannot solve the problem of not being able to hear ambient sounds off in the distance like people in a physical classroom are able to do.

Flexibility

In-person: Everyone needs to congregate in a physical space for class sessions, which reduces flexibility for those with arduous commutes or more home-care responsibilities. Also, since classrooms are shared between multiple classes, it is harder to hang around after class ends to hold follow-up chats since people from the next class are waiting to use that room.

Online: Not needing to gather in-person gives more flexibility to both instructors and students. Instructors can schedule classes and office hours even at times when they would not be able to commute to campus. It is also easier to stay around after class times to hold follow-up conversations since there is no physical classroom that needs to be vacated.

Recommendations: One way to make online tools even more flexible is to merge asynchronous forums (e.g., Piazza) with synchronous video chat so that if an instructor and student are both online, they can quickly jump from the forum to video chat to discuss harder questions. Another is to allow an instructor to help more students at once by monitoring several live screen-shares and toggling between multiple video chat sessions. This mechanism takes advantage of downtime that arises when an instructor tells a student to try something out and report back on progress [1]; they can switch to helping someone else and return later when the first student is ready.

OPEN QUESTIONS FOR SYMPOSIUM DISCUSSION

Our design recommendations are technology-focused, but technology is only one part of building future experiential learning environments. We now zoom out to discuss broader issues. For instance, there are many open questions for how people may or may not adopt such technologies. We invite symposium participants to discuss the following questions:

Setting Expectations for the New Normal

The start of 2020 was a watershed moment in that every instructor and student went through a shared experience of scrambling to transition to online learning during COVID quarantines.

- Will the shared collective memory of this event make students more open to the idea of using remote learning technologies in the future? Or did early 2020 leave a bad first impression in many students' minds since their instructors were ill-prepared to suddenly transition their classes online?
- What will be the *new normal* for experiential learning environments of the future? Will we ever return to densely-packed lab and studio spaces like Figure 1? Probably not anytime soon. Universities want students to return to socially-distanced classrooms with lower occupancy and with some students participating remotely. For lab/studio courses, how do we set expectations for mixed interactions where some classmates will be in-person and others remote?

- In mixed-mode settings, how can we design technologies and set expectations so that remote students feel just as valued and engaged as in-person ones? There are already best practices for engaging remote workers in office environments, but how do we adapt those for educational settings?

Designing for Greater Inclusion

Remote technologies can make experiential learning more inclusive, but moving online can also raise additional barriers.

- Students' home environments vary widely, with some having quiet places to work and fast internet connections, and others having little privacy and slow internet. How can we start to level the playing field here? One idea is to send students equipment such as high-quality webcams and microphones via mail. Another is to pay for subsidized high-speed cellular data plans for their phones. Finally, staffing up virtual lab hours at more times throughout the day can let students find times that fit into their diverse schedules.
- Remote technologies make it possible for students around the world to participate in the same lab/studio class. Although time zone issues make synchronous interactions harder, if there is a critical mass of students and instructors from around the world, then it may be possible to hold round-the-clock lab hours so that there will always be enough people in the virtual lab 24 hours per day. But how can we motivate global participation in experiential learning when time zone and cultural differences are widely-known barriers to remote collaborative work [9]?
- Asynchronous tools (e.g., prerecorded videos, discussion forums) are a known way to make courses more inclusive, but the very essence of experiential learning involves *high-touch synchronous interactions* in a lab or studio setting. How can we move toward semi-synchronous technologies that keep the benefits of real-time interactions while letting more students participate at times that fit their schedules?

Getting to Beyond Being There

Finally, as argued in *Beyond Being There* [2], remote technologies have the potential to surpass the fidelity of in-person interactions rather than simply being imperfect imitations.

- How can we design or adapt technologies to get to Beyond Being There for experiential learning environments? How can we get students to prefer these technologies versus just viewing them as second-rate substitutes for being in-person?
- As emphasized in *Distance Matters* [9], a major weaknesses of remote technologies is that they cannot easily foster the sorts of spontaneous interactions that occur in the hallways, by the office watercooler, or when people are hanging out before and after meetings. The analogue for experiential learning is people hanging out around the lab/studio space. How can we create remote technologies that both provide these benefits and surpass them by fitting in better with students' schedules and varied home environments?
- Text-based instant messaging, especially on mobile devices, is a major success of Beyond Being There, with many young people preferring to use it even when they are physically co-located. How can we design experiential learning tools to not be so monolithic like videoconferencing and instead be more lightweight and ubiquitous like text messaging?

CONCLUSION: CALLS TO ACTION

We call on designers to use this year's unexpected challenges as inspiration to create experiential learning environments that are more flexible and inclusive. Doing so will not only help students in existing courses but also expand educational opportunities around the world to people who cannot ordinarily access them. We believe people will now be more receptive to adopting remote technologies since everyone has gone through the collective experience of abruptly shifting to remote work in early 2020. We similarly call on researchers and policymakers to consider online-first formats even when thinking about traditionally in-person learning environments. These efforts will be critical for training the next generation of workers in creative fields such as engineering, design, and data science to face the challenges of a post-COVID world.

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