

Reflecting on Hybrid Learning in Studio-based Courses: Complications and Effectiveness during the Pandemic and Beyond

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The Covid-19 pandemic resulted in courses transitioning to fully remote learning, or considering hybrid models. Such models demonstrated great potential, making an argument for consideration even beyond the pandemic. In this paper, co-instructors of a synchronous hybrid design studio course present their experience of such a course and recommendations for future synchronous hybrid design studio courses. Through instructor reflections and student surveys/interviews, we present successes and failures of several aspects of the course, such as pre-recorded content, technology and software usage, groupwork, and project activities.

INTRODUCTION

The Covid-19 pandemic has drastically impacted education, and some fields and classes have been particularly difficult to transition to a remote learning environment. Many engineering design classes use an active learning approach (Silberman, 1996) with face to face (F2F), synchronous studios. These classes often “flip” the classroom by having students engage didactic material such as pre-recorded lectures and readings in advance and dedicating the in-class time to hands-on activity surrounding the material and project-based work (Cabi, 2018; Jared et al., 2014).

Hybrid or blended classes utilize a mix of in-person and virtual learning (Mossavar-Rahmani & Larson-Daugherty, 2007; Tsoi et al., 2005), leading to *distributed learning* (DL) i.e., situations where the instructor and students are not co-located in a physical space (Simpson & Du, 2004). Alavi (2004) details three types of DL environments: broadcast, online and collaborative, the latter two being the most employed during the recent past. Employed concurrently, the online and collaborative environments can combine to produce a robust learning model. Prior research in DL environments has shown that they facilitate effective interdependent individual and group activities (Brandt & Lonsdale, 1996), provide different modes by which students process information (Nunamaker et al., 1991), accommodate students with different access needs (Oblinger et al., 2001) and encourage informal mentorship (Campbell et al., 2016).

Online learning has been seen to be effective both asynchronously (Hiltz & Goldman, 2004) and synchronously (McBrien et al., 2009; P. J. Smith et al., 2021). In higher education, Falloon (2011) demonstrated that synchronous online learning offered a better balance of student autonomy and instructor support than its asynchronous counterpart. Duncan et al. (2012) supplement this by finding higher overall test scores and better course grades for MBA students in synchronous online models, and Strang (2013) showed that the synchronous model also offered higher effectiveness for in-class activities. There thus seems to be a notion among scholars in education that a synchronous online learning environment is preferable to an asynchronous online one.

Martin and Parker (2014) stress the importance of well-functioning technology and institutional infrastructure in

the success of synchronous online classrooms. A virtual interactive real-time instructor-led classroom should be technologically capable enough to simulate various facets of F2F classes such as small-group activities, student-led discussions and presentations, boardwork, student questions and polling, among others (Francescucci and Foster, 2013). Synchronous hybrid learning requires a robust video conferencing platform, the most commonly used ones emerging to be Zoom (Zoom Video Communications, Inc., USA) and Microsoft Teams (Microsoft, Inc., USA), paired with audio/video devices such as microphones, cameras, and document cameras.

Changing the mode of instruction requires flexibility and changes the cognitive work of teaching (Leinhardt & Greeno, 1986). Instructors must have the technological knowledge to utilize technology (Khan, 2011; Koehler & Mishra, 2005) as well as the pedagogical knowledge for designing online activities. Managing such an intricate setup can be challenging for an instructional team, and they require institutional support in their endeavor.

The on-going pandemic created some complexities for the return to campus in Fall 2021. Students were often unable to attend in person due to illness or other emergencies, necessitating a remote or asynchronous option for students. To provide an equitable and inclusive class, we taught an introductory user-centered design class in person with a synchronous online option. In this paper, we investigate its effectiveness as a model of teaching the course, and other similar design studio courses. Through instructor reflections and student surveys and interviews, we examine the various factors that played a role in the effectiveness, such as the technology usage, the distributed cognition, the ongoing pandemic and others. We asked ourselves the following research question: **How effective is a synchronous online model for teaching a design studio course, and how can it be improved?**

METHODOLOGY

User Centered Design is one of the core introductory classes that students take after being accepted into our Human Centered Design & Engineering department. About half the class is focused on a group project that follows a user centered

design process “that puts human needs, capabilities, behaviors first” (Norman, 2013). It is taught in a flipped classroom format, a structure where a majority of the instructional content and materials are made available to students in the form of readings and pre-recorded lectures to watch before they attend class, with the class time being dedicated to doubt clearing and group work sessions to apply the concepts they learned ahead of class (Jared et al., 2014). This course is a 10-week project-based exercise in which groups of students gain hands-on experience in the User-Centered design process, as they execute a design idea through the entire design cycle, from user research and initial conception to prototyping and usability testing. On any given day, the co-instructors dedicated about 50% of class time to semi-supervised group work among students, where students were allowed to work on their project components and the instructors would periodically check-in and answer questions/ provide feedback.

The co-instructors/authors taught this class fully online twice during the 2020-2021 school year, and Fall 2021 was the first time either instructor taught this class in person. Only SG taught the class in Winter 2022. The instructors decided to incorporate and encourage an in-person component with both the personal experience and a grounding in education literature (G. G. Smith et al., 2011; Tseng & Yeh, 2013) that the collaborative group work necessary for succeeding in this course was better facilitated in-person rather than online. The co-instructors also wanted to accommodate individuals who were unable to attend in person. Finally, since a major component of the course was in-class hands-on exercises and group work, the instructors chose to make the course synchronously hybrid to facilitate as much of a collaborative class experience as possible between different modes of student attendance. 36 undergraduate students, all pursuing the major, were enrolled and distributed among 10 project teams in a class that met twice a week. Project teams were assigned at the start of the quarter based on a student skills survey, where we asked questions such as their prior experience in design studio courses, strengths and weaknesses among design skills, and preferences for meeting in-person or remotely. The number of in class and remote students fluctuated throughout the quarter. Following recommendations found from other educators (Choichnov, 2021; Chua et al., 2019; van Leeuwen et al., 2013), the instructors were co-located in person and utilized two laptops, two projectors, and a Meeting Owl Pro (Owl Labs Inc., USA) video-conferencing camera/microphone to stream the class on the videoconferencing platform Zoom with auto-captions. The Meeting Owl Pro (hereafter referred to as ‘Owl’) was chosen for some of its helpful features, such as being able to clearly pick up spoken words from over 20ft, having a scoping camera that detected audio and focused on the source of the sound, and a 360° field of view. The classroom, which had a capacity of 60, was stocked with supplies for design work, such as stationery, post-it notes, tape, and craft supplies. For in-class activities, the instructional team used online collaborative softwares such as Google Suite products (Alphabet Inc., USA), and Miro (Miro, USA).

To describe the cognitive work system of teaching the class in a synchronous hybrid format, the instructors reflected upon their own teaching experiences. Based on prior work around such reflection (Austin & Hickey, 2007; Coia & Taylor, 2009), the instructors reflexively examined their experiences around the various aspects of the course such as lesson-planning for a hybrid class, preparing the pre-recorded materials, designing in-class activities for distributed teams, navigating and maintaining technology to setup the classroom, and evaluating student work equitably, among others.

To understand student experiences, all students enrolled in the class were invited to participate in an anonymous questionnaire and semi-structured interviews after the end of the term and after grades were submitted. The questionnaire consisted of 13 questions with multiple choice, likert-type, and open-ended questions. The semi-structured interviews ranged between 30 and 45 minutes per interview. Participants were screened out if they were currently enrolled in a course taught by one of the authors. The local IRB deemed this exempt research, but researchers obtained verbal consent from participants to participate and be recorded.

RESULTS

Instructor Reflections

Assembling Technological Setup. Through several trial-and-error processes, the co-instructors determined a working setup shown in Figure 1 below and documented their process.. They split the tasks and responsibilities between them, but found that the complicated set of tasks required a lot of teamwork when one would forget a step. The technology sometimes did not work as expected which added to the cognitive load and stress.



Figure 1: Image of technology setup for the course, consisting of two laptop computers, an Owl, and two projectors (one not shown)

Facilitating Hybrid Instruction. We observed that about 15/36 students on average would attend class in-person, with the remainder attending remotely. Some of the class activities worked for both modes because they leveraged online tools, and others needed to be re-created for in-person or have two versions. Remote students were placed in breakout rooms for activities and called back for whole class

discussions. It was difficult for remote students to hear and participate in whole class discussions. The hybrid structure was also effective when one of the instructors was injured, because it allowed them to teach remotely.

Facilitating Hybrid Teamwork. The remaining group time would be dedicated to group work for students to work on their projects, and the instructors would periodically visit groups to provide feedback and answer questions. To facilitate cross-platform collaboration, instructors would ask in-person students to join the class Zoom and sort students into breakout groups, unless a group was fully in-person.

Student Outcomes: Students met course learning objectives and produced quality work. All groups, irrespective of their modes of attendance, performed well in the class, achieving GPAs above 3.9 while delivering well-designed solutions to timely and relevant problems in their group projects.

Student Surveys

Twelve students responded to the anonymous survey. 8/12 of the students said that they attended class either in-person or synchronously online (they could select multiple answers), 3 always attended in person, and 1 attended only online. Of the 11 students who attended in-person, 5 did so for 9/10 weeks. For the 9 students who attended online, they chose several reasons for doing so, such as personal learning preferences (chosen by 6/9 students), teammate preferences (6/9), mental/emotional health (5/9), fears for contracting the virus (4/9), concerns for personal physical health (3/9), weather (3/9), transportation difficulties (2/9), fear for the health of immunocompromised roommates/family (1/9) and class time being too early (1/9).

In terms of the instruction, 5/12 students agreed that the online and in-person components of the course were equally engaging. Only 4/12 students found the Zoom instruction to be helpful, while 9/12 agreed that the in-person instruction was helpful for learning. 9/12 students also found the hybrid format and the ability to choose their preferred mode of attendance very helpful for their course experience.

In terms of class components, 10/12 students indicated that they found both the in-class synchronous activities and the assigned readings contributed positively to their learning. 8/12 students also indicated that the pre-recorded lectures were helpful, though only 7/12 students could say that they watched most lectures to completion.

11/12 students indicated that they felt that the instructors both cared for their learning in the course and for their well-being as human beings. 12/12 students agreed the instructors both used technology effectively to manage the classroom and worked well as a teaching unit.

In terms of their own project teams, 6/12 students indicated that their project teams met mostly in person, and 11/12 students agreed their teams used technology effectively. 9/12 students reported both that their teams communicated effectively and that the teams worked well together, and 8/12 students formed friendships and bonds between their

teammates that transcended the class. One student wrote, “The main reason hybrid worked in this class better than I have had it in others is that my group was very communicative. We worked together and always talked before class when someone was going to be online instead of in person.”

Student Interviews

We conducted six interviews with students, hereafter referred to as P1-6. Some salient findings are presented below.

Design Studio Experience and Preference.

Participants varied in design experience. Prior to this course, P1 had taken 10 design studio courses (4 in person and 6 online) and spoke about greatly enjoying such courses, particularly the opportunity to “do creative work and explore a problem space without a definite right or wrong answer.” In contrast, this course was P2’s first design studio course, though they had previously taken a course that employed an asynchronous hybrid structure (pre-recorded lectures with in-class discussion). But even with this single course experience, P2 mentioned that they enjoyed the “open-endedness” of design studio courses, remarking that they enjoyed the ability to “explore an open-ended project however you want with only some basic requirements.”

Experience with Hybrid Structure. P1, P3, P4, P5 and P6 primarily attended classes in person. P1 indicated that they greatly enjoyed the hybrid nature of the course, reflecting on it as “an in-person class with online options”. They mentioned that their group primarily met in-person, and that they personally appreciated that. They recounted a specific instance where they were working with their group in-class and overheard a conversation from a different group, leading them to “lean in and ask questions, which led to learning something new for [their own] project.”

Participants mentioned two primary reasons for choosing to attend class in-person: teammate preferences (discussed later) and learning preference. They mentioned that after the long remote year, they looked forward to attending a collaborative class in-person. They also found comfort in the fact that the classroom was large and they could adequately distance from other students (P1). They appreciated being able to attend class “and see people’s faces, not black boxes on a screen” (P6). P4 and P6 also preferred in-person attendance because they could leverage the design supplies of the room in their project work. Though P3 only attended in person, they did not feel that having some of the class remote affected their learning experience. P6 also expressed that while they never availed the remote option, they liked having the option.

P2 also appreciated the hybrid structure, but for a completely different reason. P2 talked about fracturing their leg within the first week of school, necessitating a fully remote participation in the course. They mentioned that the hybrid structure “benefitted them enormously, because [they] could still participate equally from home.” They did come in a few times with one of their teammates, in order to work on their prototypes using the supplies in the classroom.

Experience with Groupwork. P3 and P6 were assigned the same project group based on their preferences for in-person attendance, and mentioned attending in-person classes for group work. They strategically decided on which tasks to complete during in-person meetings, such as building their physical prototype, and which tasks would be better suited to remote collaboration, such as working on storyboards or personae. P3 said the in person time helped them build “solidarity” as a team. P1 and P4’s groups also primarily met in-person during class times, with the only exceptions being in circumstances where one of the group members could not attend class in-person, in which case the whole group attended remotely. P1 appreciated the ability to make this choice on a day-to-day basis.

In contrast, P5 attended class in-person even though their group members mostly did not. P5 said that even though they were the only person coming in, it allowed them to “both work on the project and get questions answered easily.”

P2’s group primarily met remotely, both because of their pre-quarter preferences and because of individuals’ medical conditions over the quarter. While the hybrid structure facilitated their participation in the course, P2 mentioned that it also created a difficulty. One of their group members was very unresponsive and would rarely attend class, putting the bulk of the work on the rest of the team. P2 imagined that if the course was completely in-person, it might have made their elusive teammate more inclined to attend class and contribute more to the group project.

Experience with Course Technology. P1 appreciated the use of the Owl as opposed to just instructors’ computer-builtin microphones, since it allowed them to “hear both instructors, which is not a thing that is usually effectively done in online classes.” P4 also enjoyed the scoping feature of the Owl, since it allowed them to see other students in the room when they personally attended remotely, giving the remote experience a slightly more in-person feel. This feature was also appreciated by P2 for similar reasons, who also liked the presence of two projector screens when they came in-person, because it made it such that they could see the shared content from any position in the room.

Experience with Online Instructional Software. Both P1 and P2 specifically mentioned their dislike for Miro usage. P1 preferred using physical sticky notes instead of Miro boards, indicating that they “didn’t like it when someone moved their stuff.” P2 found Miro “annoying”, especially the fact that several interactions needed a lot of mouse-clicking, something they generally dislike. P1 and P2 especially found Miro difficult during class activities where everyone was required to be on a single Miro board at the same time.

P5 and P6 enjoyed the usage of Figma for project work, but mentioned that they would have liked to see more formal instruction on how to use Figma effectively, potentially bringing in someone to guest-lecture on the multiple ways in which Figma can be used for prototyping.

We sought to analyze the effectiveness of a synchronous Introduction to User Centered Design course through instructor reflection as well as student surveys and interviews. As instructors, it can be difficult to know how students experience new modes of instruction, thus it is important to solicit their input as we iterate on course design. Our results indicate that students had favorable experiences with the course, leveraging in-person and remote affordances to suit their individual and changing needs, obtaining a good learning experience while being able to prioritize personal physical and mental health. We thus determine that the hybrid setup was conducive to student experiences with the course, and did not negatively impact their course experience.

Technology was an important component of the hybrid course experience. Running the course elements and tools required technical proficiency for all. The instructors designed a complicated socio-technical work system that required distributed cognition and attention to multiple tasks. Overall the tools that were utilized were appropriate and afforded necessary pedagogical interactions (e.g: breakout rooms in Zoom, Owl camera, digital whiteboards on Miro). However, students still preferred the analog versions of the activity (e.g: in-person discussions and physical whiteboards).

The synchronous online option provided flexibility for students to participate when illness or other circumstances prevented them from coming to campus. Students appreciated the option to stay home when sick or injured. They also appreciated having the agency to make this decision with their teams to decide the best mode of attendance. In addition, when one instructor was injured, they too appreciated the option to participate remotely.

Similar to previous research, there were aspects of in-person learning that were preferred over remote learning (Dagman & Wärmefjord, 2022; P. J. Smith et al., 2021). Students and instructors discussed the informal conversations that happen more easily in-person. Students also appreciated the ability to collaborate both within and across groups in in-person settings, and being able to leverage design supplies available in the classroom. In addition, pre-recorded lectures were less effective, and students would have preferred being able to ask guest lecturers questions.

Overall, the hybrid setup did not negatively affect the main group design project. Students were separated into teams with similar schedules and remote or in-person preferences, and teams were successful regardless of attendance mode. Students expressed agency to coordinate with their teams using a variety of tools. It was more difficult to follow the progress of remote teams, and instructors used mid-term assessments and check-ins to communicate with these teams.

Based on our findings, we recommend that hybrid design studio courses use a videoconferencing camera/microphone to stream class synchronously over a video conferencing platform with auto-captions. To reduce the split attention and cognitive load on instructors, we recommend that a dedicated staff member runs the remote session, and that students are encouraged to communicate access issues. These suggestions will require institutional

ANALYSIS AND DISCUSSION

support and funding. We recommend more formal check-ins for remote students and encouraging more informal collaboration and peer review. Miro did not meet student needs for a whiteboard replacement, so there is an opportunity to design a better tool.

Though necessitated by the on-going pandemic, the increased use of hybrid learning should persist to provide an inclusive and equitable education for all students (Castro, 2019). This small case study demonstrated that it is possible to deliver project-based design studio courses in a hybrid format, catering to individual students' needs while still maintaining the effectiveness of the course. The hybrid format provides students the agency to choose their preferred mode of attendance, prioritizing their physical and mental wellbeing. We will incorporate findings into future iterations of this class and similar project-based design studio courses. We thank HCDE for department funds which supported this project.

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